Navigation Improvement Study
Reconnaissance Report

Hockanum River at Union Pond Manchester, Connecticut

US Army Corps of Engineers
New England Division

JANUARY 1990

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	October 1989	Reconnaissance Report

4. TITLE AND SUBTITLE
Hockanum River At Union Pond, Manchester, Connecticut
Navigation Improvement Study
Reconnaissance Report

5. FUNDING NUMBERS

6. AUTHOR(S)
U.S. Army Corps of Engineers
New England Division

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
U.S. Army Corps of Engineers, New England Division
424 Trapelo Road
Waltham, MA 02254-9149

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
U.S. Army Corps of Engineers, New England Division
424 Trapelo Road
Waltham, MA 02254-9149

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES
This study, for the purpose of navigation improvement, was accomplished under the authority of Section 107 of the River and Harbor Act, 1960 (PL 86-645), 33 USC 577

12a. DISTRIBUTION/AVAILABILITY STATEMENT
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12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)

This report is to assess the feasibility, economic justification and environmental acceptability of deepening the upper third of Union Pond in order to develop the pond into a public recreational area. Two of the pond's major problems are its shallow nature and poor water quality. The project would involve deepening the upper third of the pond to a minimum of 5 feet below the spillway crest elevation. Draining the pond and excavating 15,700 cubic yards of material, which involves disposal of such material, is needed. Non-Federal interests include the construction of improved public facilities. The question of the safety of the Union Pond Dam is addressed but not in any detail as parts of the structure need to be reexamined.

For the purpose of this reconnaissance study, project benefits would be generated by the value of recreational time realized by the users of the improved pond. Comparing the benefits to the annual costs of $37,100, it is determined that the project does not qualify for Federal participation and no further Federal study is recommended.

14. SUBJECT TERMS
Hockanum River; Union Pond; spillways; drainage; dams

15. NUMBER OF PAGES
204

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
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HOCKANUM RIVER
AT UNION POND
MANCHESTER, CONNECTICUT

NAVIGATION IMPROVEMENT STUDY
RECONNAISSANCE REPORT

OCTOBER 1989

PREPARED BY
DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

CONTINUING AUTHORITIES PROJECT FACT SHEET
HOCKANUM RIVER
NAVIGATION IMPROVEMENT PROJECT

Date: January 1990
New England Division

1. Project: Hockanum River
at Union Pond
Manchester, Connecticut
CWIS # 87635

State: Connecticut
County: Hartford
Congressional District: 1st

2. Authority: Section 107 of the 1960 River and Harbor Act, as amended: Navigation.

3. Location of Study Area: The Town of Manchester is located about 8 miles east of the city of Hartford.

4. Problems, Needs and Opportunities Identified: The major navigation problem identified in Union Pond is a lack of available deep water and poor water quality. These factors have limited and restricted expansion and development of public recreational facilities. However, opportunities do exist in the Hockanum River at Union Pond for the expansion of public parks and recreational use centered upon the pond and its valuable potential to support navigation as well as other water related activities.

5. Alternative Plans Considered: Only a single plan of reconnaissance scope was evaluated. The evaluated plan involved the dredging of the upper pond to provide a minimum depth for navigation for the entire pond. In order to provide for the types of activities the town wishes to develope; boating, swimming, sailboarding, fishing, etc, a depth of 5 feet BSE would be the miminum necessary. About 14 acres of the upper reaches of the 52 acre pond would need to be dredged. Incremental depths of 5, 6, 7 and 8 feet below the spillway crest elevation (BSE) of the Union Pond Dam were considered. An improved boat ramp and parking areas sufficient to accomodate the projected level of use, as well as potable water service would also need to be providedby non-Federal interests.

6. Description of the Evaluated Plan: As desired by local interests, the evaluated plan provides for improvement dredging in Union Pond to a minimum depth for small boat navigation over the entire pond . In order to accomplish this, an area of about 14 acres would be excavated to a depth of 5 feet BSE. It would involve the removal of approximately 85,500 cy of ordinary material, which would be disposed of at an active landfill site located about 7 miles north of the project site.

7. Views of Sponsor: The Manchester Planning Office has indicated the towns support for the proposed project. In a letter dated December 22, 1989, the planning director stated that he had completed review of the draft Reconnaissance Report, and that while he was disappointed that no Federal action was recommended, the town found the report's contents useful for pursuing the project on their own.

8. Views of Federal, State and Regional Agencies: Coordination with Federal and state resource agencies was accomplished during the study and and these agencies contributed available data. Concerns with water quality will persist until upriver waste treatment plants are replaced or upgraded. As estimated by state and local interests, completion of this clean-up process is not anticipated until 10 years from now. Contact recreational activities in Union Pond, such as swimming, would not be possible until then. The contaminated nature of the sediments to be dredged is of concern, particulary as it relates to disposal of the excavate. Concern with construction impacts on aquatic life, including fish stranding during pond drawdown, have been expressed. Further, the continued poor condition of the Union Pond Dam would preclude implementation of any navigation project until the structure is brought up to a safe condition.

9. NED Plan: An NED Plan was not identified and this reconnaissance report does not recommend further study by the Corps.

10. Status of NEPA Document: Initial coordination with resource agencies has revealed no unresolvable significant issues which would impact further study.

11. Significant Effects: See Table 1.

12. Implementation schedule: N/A

13. Supplemental Information: Findings: In the absence of improvements to water quality and further repairs to the Union Pond Dam, it is the conclusion of this reconnaissance scope study that Federal participation in the implementation of the desired navigation improvements cannot be be undertaken.

FACT SHEET
TABLE 1

ECONOMIC AND FINANCIAL DATA
EVALUATED PLAN
(All costs in thousands of dollars)

Estimated Implementation Costs:
(January 1989 price level)

Federal	$125.0
Non-Federal	206.0
Total	$331.0

Economic Data:
(8 7/8%, 50 year life)

Annual Charges: $37.1
(Includes $7.3 OM&R)
Federal OM&R = None
Annual Benefits: $17.8

BCR: 0.48

Non-Federal Requirements:

Berthing and Facilities	$ 81.0
Cash	125.0
Reimbursements	--
TOTAL	$206.0

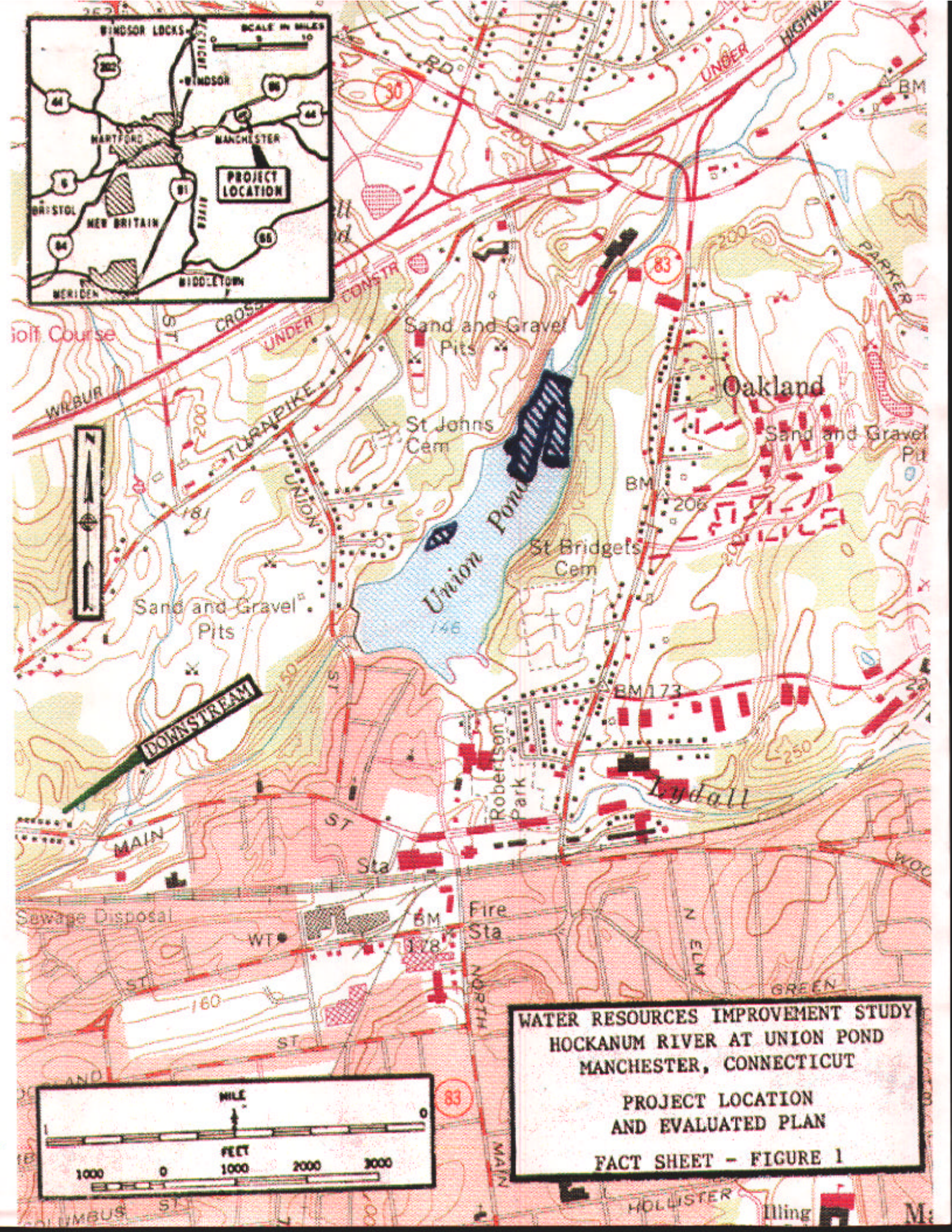
Cost Allocation:

Single Project Purpose	Federal	Non-Federal	Average Annual Benefits
Recreational Navigation			
Commercial Output	----	----	None
Recreational Output	$125.0	$125.0	$17.8 (100%)
Total	$125.0	$125.0	$17.8

Federal Allocations to Date:

Reconnaissance	$ 70
Feasibility Study	None
TOTAL	$ 70

Remaining Federal Requirements: None



WATER RESOURCES IMPROVEMENT STUDY
HOCKANUM RIVER AT UNION POND
MANCHESTER, CONNECTICUT

PROJECT LOCATION
AND EVALUATED PLAN

FACT SHEET - FIGURE 1

Town of Manchester

41 Center Street

Manchester, Connecticut 06040

RICHARD J. SARTOR, GENERAL MANAGER

December 22, 1989

Colonel Daniel M. Wilson
Department of the Army
Corps of Engineers
Planning Division
New England Division
424 Trapelo Road
Waltham, MA 02254-9149

Re: Hockanum River at Union Pond - Reconnaissance Report

Dear Colonel Wilson:

I have recently completed my review of the Hockanum River Union Pond Navigation Improvement Study report dated November 1989. While we are naturally disappointed that the Corp has determined that there should be no further federal participation in this project, the report contained valuable information which I am sure the town and its consultants will find useful in pursuing recreational development of the Union Pond.

I would like to offer the following comments regarding the draft report:

- On page 9 of the draft the second paragraph states that "The town also owns other shore front parcels, most notably the cemetery along the eastern shore." This statement is erroneous. The cemetery parcel on the eastern shore is owned by the Catholic Cemeteries Association. We are negotiating with the Association for permanent access easement rights for the Hockanum River Linear Park trail system.

- The last paragraph on Page 13 identifies Laurel Lake as one of two major water bodies in Manchester comparable in size to Union Pond. In fact, Laurel Lake was created by an impoundment structure which was breached at least 10 to 15 years ago. It is now more accurately described as Laurel Marsh and the Hockanum River meanders through former lake bed.

I have forwarded the reconnaissance report to our director of Public Works and advised him of the deadline within which he must submit comments to you.

Sincerely,

Mark Pellegrini
Director of Planning

cc: Peter Lozis, Jr., Director of Public Works

MP:pgw

EXECUTIVE SUMMARY

This report, prepared by the New England Division, Corps of Engineers at the request of the town of Manchester, Connecticut, was accomplished under the continuing authority of Section 107 of the River and Harbor Act of 1960, as amended.

Union Pond is formed by the Union Pond Dam on the Hockanum River. The pond is about 52 acres in size and has depths generally ranging from two to 20 feet. The dam was originally constructed in the 18th century and has been modified several times since, most recently in 1901 when it was raised. This action flooded the present upper third of the pond to a depth of 2 to 3 feet.

The town of Manchester desires to develop Union Pond into a public recreational resource. As part of this goal the town has aquired several shorefront properties for park development. The town has also completed substantial repairs to the Union Pond Dam.

The town views the shallow nature of the pond's upper reaches as a detriment to public use development. Further, pond sediments in this segment of the pond are viewed as a source of some of the pond's poor water quality problems, which have discouraged swimming, boating and other recreational activities. However, water quality is primarily affected by upstream sources of pollution.

This report examined the feasibility, economic justification and environmental acceptability of deepening the upper third of Union Pond. A minimum depth for the whole pond of 5 feet below the spillway crest elevation was used in this evaluation, as it would be sufficient to allow small boats to use the whole pond, as well as enable local development of public shore access at town owned land along the northwest shore. Non-Federal interests would need to construct public access facilities including an improved boat ramp, parking areas and utility services to support the improvements considered.

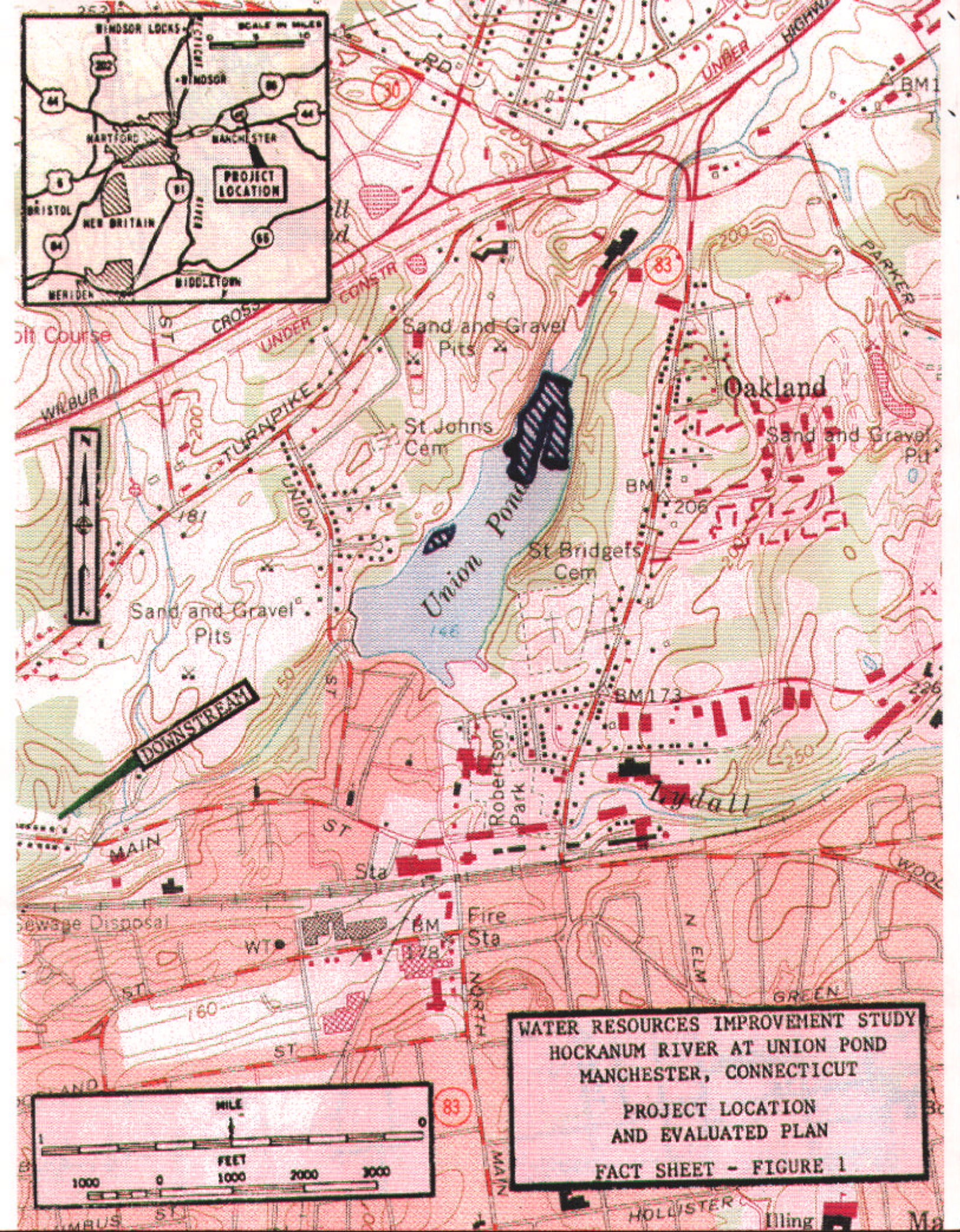
Construction of the project would require the draining of the pond and the excavation of 15,700 cubic yards of ordinary material. The excavated material would be loaded on trucks and hauled to a nearby landfill site for disposal, if found to be suitable and environmentally acceptable.

The cost of constructing the improvements is estimated at $331,000, including $250,000 for excavation and disposal of the material, and $81,000 for ancillary shore facilities.

Questions do remain as to the suitability and safety of the Union Pond Dam. Repair of the structure undertaken by the town in 1988 were confined to only the southern third of the structure. The remaining areas still exhibit significant problems. These problems need to be adressed before a Federal navigation project could be considered for Union Pond. The extent and cost of such repairs were not quantified as part of this report and would require further study.

For the purpose of this reconnaissance study, project benefits would be generated by the value of recreational time realized by the users of the improved pond. Annual recreational navigation benefits so evaluated were determined to be $17,800. These benefits compared to annual costs of $37,100 yielded a benefit cost ratio of 0.48.

This project, therefore, does not qualify for Federal paricipation, but certainly could be undertaken by non-Federal interests should they so desire. No further Federal study is recommended . for the Hockanum River at Union Pond, at this time.



WATER RESOURCES IMPROVEMENT STUDY
HOCKANUM RIVER AT UNION POND
MANCHESTER, CONNECTICUT

PROJECT LOCATION
AND EVALUATED PLAN

FACT SHEET - FIGURE 1

HOCKANUM RIVER AT UNION POND
MANCHESTER, CONNECTICUT
NAVIGATION IMPROVEMENT STUDY

Reconnaissance Report

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INTRODUCTION

Union Pond is located on the Hockanum River in Manchester, Connecticut, about 11.25 river miles above its confluence with the Connecticut River at East Hartford. The Town of Manchester, with a 1987 population of approximately 51,000 residents and an area of 27.6 square miles is located about 8.5 miles east of the city of Hartford in Hartford County along Interstate 84.

Union Pond, as shown in Figure 1 is an impoundment formed by the Union Pond Dam. There is not, at present, any significant navigational activity, or improved public access facilities at the 52-acre pond. However, about one-third of the shoreline is municipally owned and the town is planning to construct boat ramps, access and parking to facilitate public recreational navigation.

The dam and pond level were raised in 1901, flooding an adjacent floodplain area, which comprises the upper third of the pond, to a depth of about 3 feet. Since the raising of the pond, material derived from upstream erosion has been carried into the pond by the Hockanum River and deposited atop and along the downstream slope of this submerged floodplain. This shoaling and the shallow former flood plain restrict the depth of water and therefore the pond's storage capacity, water quality and value as a recreational resource. The town completed repairs to the dam in 1988. However, the repairs were insufficient to result in upgrading the dam's geotechnically unsafe condition.

STUDY AUTHORITY

This study, for the purpose of navigation improvement, was accomplished under the authority of Section 107 of the River and Harbor Act of 1960, PL 86-645, 33 USC 577, as amended.

Local officials and congressional interests contacted the New England Division concerning Union Pond in May 1988. The New England Division, after site investigation and consultation with local officials, initiated this Section 107 study in January 1989.

STUDY PURPOSE AND SCOPE

The purpose of this Reconnaissance Study was to determine whether further planning to alleviate navigational restrictions and augment local development of public recreational facilities at Union Pond on the Hockanum River, was in the Federal interest.

Toward this end, a likely plan of improvement, supported by the non-Federal sponsor, the town of Manchester, was developed and evaluated. Potential impacts of this plan on natural and cultural resources were identified. The scope of additional investigations, which would be required should these improvements be considered further, were developed in consultation with state and Federal agencies who have regulatory responsibility for projects of this nature.

PRIOR STUDIES AND REPORTS

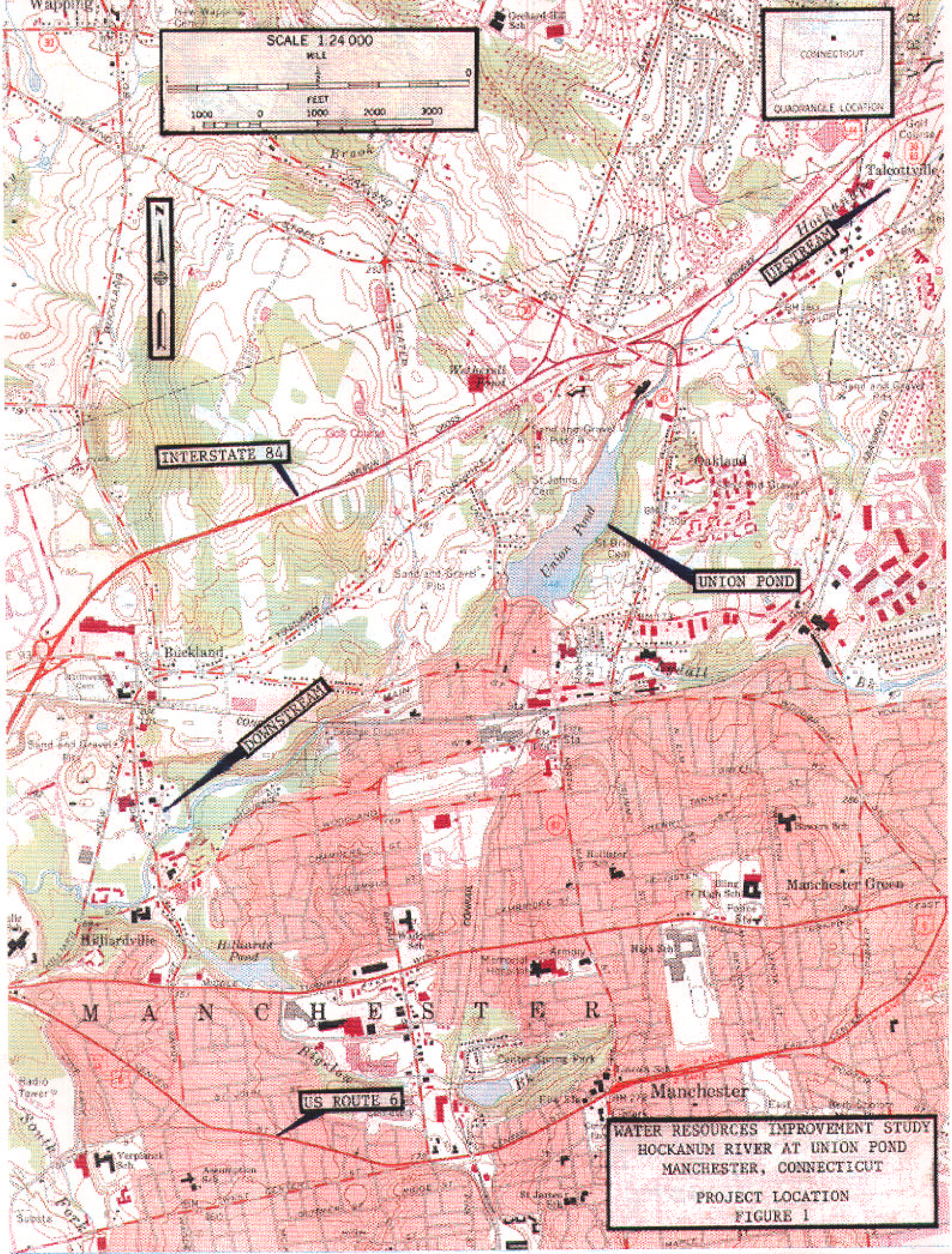
Federal Studies

There is no existing Federal project, for any purpose, for either Union Pond or the Hockanum River.

The Town of Manchester first requested Corps involvement in improvements to Union Pond in March 1964. The town had requested a study of water pollution problems in the pond and cited the Hockanum River as the source of the pollution. The Corps, lacking any authority that would permit its involvement in such a study, referred the town to state agencies and the U.S. Public Health Service.

The Town of East Hartford, located at the river's confluence with the Connecticut River, requested Corps involvement in a Hockanum River clean-up project in November 1964. Due to lack of authority for Corps involvement in such a project, the town was referred to the state Water Resources Commission.

A Flood Plain Information Report for the Hockanum River in the Town of Vernon, Connecticut, located upstream of Manchester was published in June 1965. The report's purpose was to provide the town with guidance on flood plain zoning and land use planning.



WATER RESOURCES IMPROVEMENT STUDY
HOCKANUM RIVER AT UNION POND
MANCHESTER, CONNECTICUT

PROJECT LOCATION
FIGURE 1

In February 1979, a Phase I Inspection Report was prepared for the Union Pond Dam under the authority of the National Dam Inspection Program. The dam was found to be in an unsafe condition, and recommendations as to studies, repairs and continuing .monitoring and management were made. In particular the report found the stability of the structure to be marginal and identified the spillway as seriously inadequate. The town's 1988 reconstruction of a portion of the dam has adressed some of these concerns. An update of the inspection report based upon a visual inspection is included as an appendix to this report.

In January 1984, the towns of Vernon and Manchester requested Corps assistance concerning flooding problems along the Hockanum River in the vicinity of the boundary between the two towns. A reconnaissance investigation was subsequently conducted under the authority of Section 205 of the 1948 Flood Control Act. The Reconnaissance Report, an initial appraisal published on July 3, 1984, found that no further Federal study was warranted, based on the relatively minor extent of flood damages and the resultant lack of economic justification.

Non-Federal Studies

The town of Manchester is conducting a study of the Hockanum River examining the requirements for establishing a linear park along the river. The towns of East Hartford and Vernon are undergoing a similar process, all under a state program. Such a park would increase public access to the river and recreational uses. Hiking trails, bike paths, picnic areas and other recreational facilities are planned along with water access. The town has contracted a consulting firm to prepare a diagnostic feasiblity study of the Hockanum River including Union Pond as part of this effort.

PROBLEM IDENTIFICATION

This portion of the report describes the historical setting, existing conditions and trends, and discusses the nature and scope of the problems associated with navigation, flood control and water quality. From analysis of these conditions and problems, planning objectives and constraints were identified and used to direct the formulation of alternative potential solutions.

HISTORICAL CONDITIONS

The Town of Manchester, previously known as Oxford Parrish, was incorporated in 1823. Union Pond Dam was the site of one of Connecticut's first paper mills, which later burned in 1778. The date of construction for the original dam is unknown. The Samuel Pitkin Mill was built at this site in 1794 and was the first cotton mill built in Connecticut. The mill became the Union Manufacturing Company in the early nineteenth century and developed into one of Manchester's leading employers.

The company constructed a new dam at the site in 1866. The remains of this stone dam, the third to be built at this location, remain buried beneath the present concrete structure. The dam was raised to its present height in 1901. This action flooded the upper third of the pond which the town now wants deepened.

The Union Manufacturing Company consisted of as many as 35 buildings constructed south of the dam at the height of its operations. However, the company's business declined and the mill closed by 1890. Another textile company, the Hormell Brothers, operated in part of the original plant. Their wool scouring business attracted the complaints of downstream users who objected to the pollution caused by the plant. A second wool scouring company later occupied the site for a short time. About 1900, the Cheney brothers, a silk manufacturing compnay, bought the water rights to Union Pond, raised the dam and used it to generate electricity. The operation later became the property of the Connecticut Power Company.

The Connecticut Historical Commission has stated that the Union Manufacturing Company and its associated structures, which no longer exist, was once of archaeological importance. The commission further stated that the recent highway improvements for Union Street and the town's reconstruction of the dam have destroyed the site's scientific integrity and its National Register potential. The Historical Commission did concur with the New England Division's assessment that the pre-1901 floodplain, which is being proposed for excavation, may possess prehistoric archaeological sensitivity and that further studies would be required to satisfy the provisions of the National Historic Preservation Act of 1966, as amended, should planning for this project proceed further.

EXISTING CONDITIONS

The drainage area of the Hockanum River is about 76 square miles, of which 53.9 square miles are located above the Union Pond Dam. Much of the drainage area is rural, but increasing residential and commercial development is underway. The normal pool elevation of the pond, at spillway crest is 142.3 feet NGVD. The pond's length is about 3,300 feet and its storage capacity is 515 acre-feet. The Hockanum River basin is shown in Figure 2.

Union Pond Dam

During the summer of 1988, the town of Manchester, current owner of the dam, performed a rehabilitation project for the Union Pond Dam. The dam, as reconstructed, is an L-shaped concrete gravity structure, with a total length of about 590 feet. About 200 feet of this is an earthdike with a sheet pile cutoff wall along its center having a top elevation of 148.0 feet NGVD. Due to Union Pond's small size relative to the area of the Hockanum River's drainage basin, the dam has no measurable flood control capacity.

The spillway is a trapezoidal broad crested weir consisting of an outer concrete shell over a core of earth and rubble. The spillway has a crest elevation of 142.3 feet NGVD, about 5.7 feet below the top of the abutments, and has right and left (north and south) portions approximately 104 and 194 feet in length, respectively. The existing dam was built over the original nineteenth century stone dam which was founded on a bedrock ridge.

The inspection report conducted as part of this study is included as Appendix C to this report. Field inspection found the dam to be in fair to poor condition. The town's 1988 reconstruction only partially addressed the concerns presented in an earlier 1979 Dam Inspection Report. The 1988 rehabilitation work focused on the southern 90 feet of the concrete spillway adjacent to the gatehouse site. The remaining 208 feet is in generally poor condition exhibiting significant spalling and cracking, with seepage observed through the cracks and at the spillway's toe.

The 1988 rehabilitation work also included raising the abutments by about 1.7 feet with concrete caps and raising the dike crest by about 1.3 feet with a sheet pile wall. These improvements increased the spillway capacity at the top of the dam by about 70 percent, from 8,400 cubic feet per second (cfs) to about 14,300 cfs.

A series of vertical steel pipes are spaced along the spillway crest. These could be struck by and trap floatable debris, which during periods of high flow could lead to localized instability in the spillway crest of the structure. These and other conditions relative to the Union Pond Dam are presented in detail in Appendix C - Inspection Report

Environmental Setting

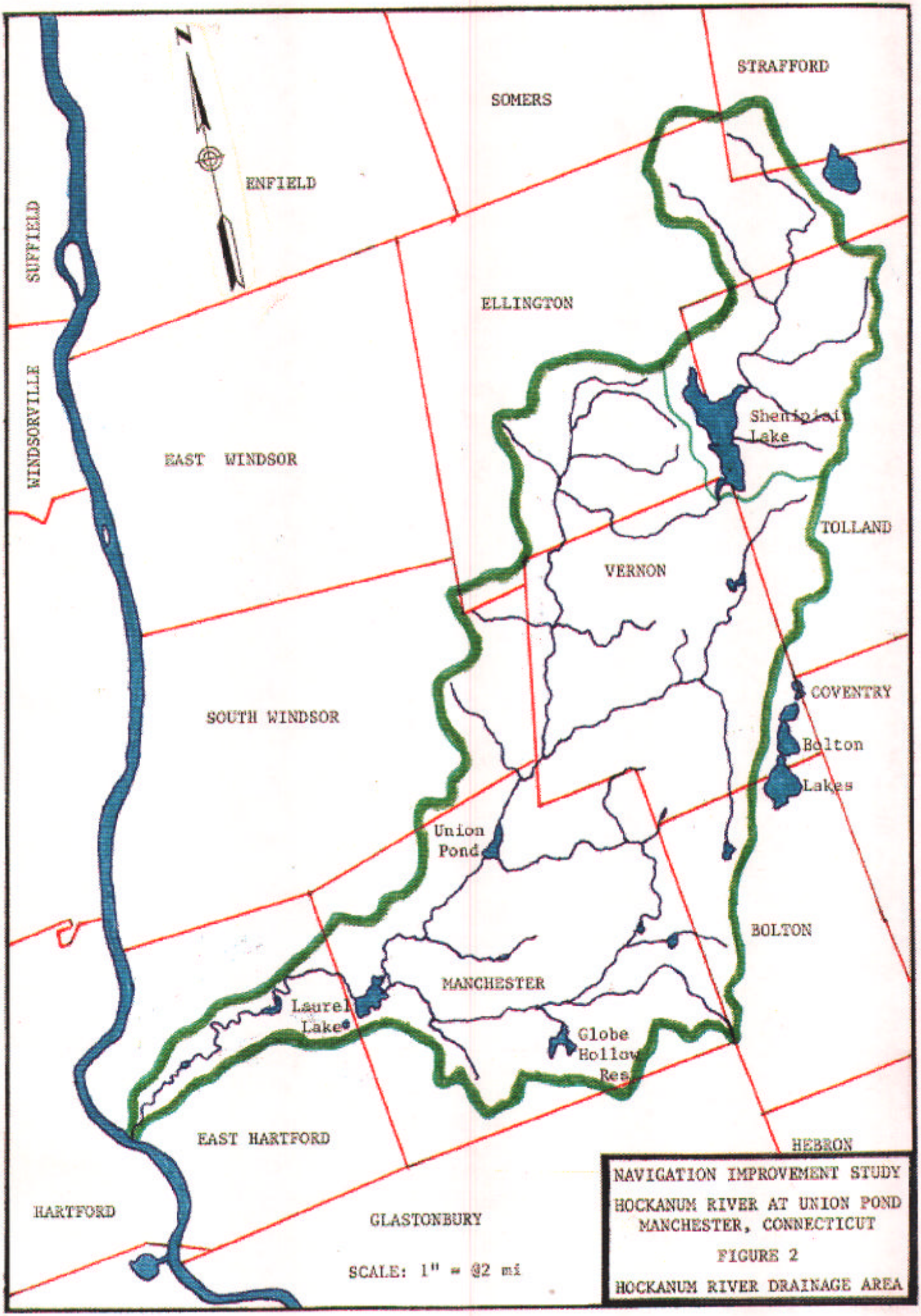
The area around Union Pond is a developed suburban environment. The pond is surrounded by deciduous forest and residential developments. A sand and gravel quarry is located at the northeast corner. An open public park is located at the southeast corner.

The Hockanum River empties into Union Pond from the northeast, carrying industrial and agricultural runoff and siltation. The topo- graphic slope of the shoreline is steep except along the southeast park and residential areas south of the dam. The steep shore results in a lack of wetlands adjacent to the pond. A small stream enters the pond in the southeast corner east of the park.

The U.S. Fish and Wildlife Service has determined that ''no Federally listed, or proposed threatened or endangered species under their juris- diction, are known to occur in the project area, with the exception of occasional transient individuals.'' Therefore, no further consultation with the Service is required under Section 7 of the Endangered Species Act. The Connecticut Department of Environmental Protection (CTDEP), Natural Resources Center, determined that there are no known extant populations of Federally Endangered or Threatened species or Connecticut ''Species of Special Concern'' occurring at the project site.

Water Quality

The Hockanum River originates at the outlet of Shenipsit Lake, a water supply reservoir located above the Rockville section of the town of Vernon. About 54 square miles of the 76 square mile watershed of the river are located above Union Pond. The Hockanum River has historically exhibited poor water quality. The river's waters are classified as Class C type surface water by CTDEP. Class C waters are suitable for certain fish and wildlife habitat, certain recreational activities, agricultural and


N
STRAFFORD
SOMERS
ENFIELD
SUFFIELD
ELLINGTON
WINDSORVILLE
EAST WINDSOR
Shenipsit Lake
TOLLAND
VERNON
COVENTRY
SOUTH WINDSOR
Bolton Lakes
Union Pond
BOLTON
MANCHESTER
Laurel Lake
Globe Hollow Res
EAST HARTFORD
HEBRON
HARTFORD
GLASTONBURY
SCALE: 1" = @2 mi
NAVIGATION IMPROVEMENT STUDY
HOCKANUM RIVER AT UNION POND
MANCHESTER, CONNECTICUT
FIGURE 2
HOCKANUM RIVER DRAINAGE AREA

industrial uses and navigation, however, swimming may be precluded. The adopted standard or goal for the Hockanum River is Class B. Class B waters must have water wquality conditions suitable for swimming and provide good habitat for aquatic life.

Historic sources of contaminants in the Hockanum River include industrial discharges from numerous textile and paper mills located at Rockville, and agricultural runoff from other upstream areas. As industrial use of the river has declined over the past half century, the industrial point sources of contaminated effluent have been eliminated. Union Pond is the first impoundment downstream of the Rockville area, and therefore acts as a collection basin for sediment and contaminants carried downstream from the upper drainage basin.

The only remaining point source of pollution along the Hockanum River is the Vernon Sewage Treatment Plant (VSTP). According to CTDEP, the discharged effluent from VSTP represents a significant amount of the total flow of the Hockanum River. To comply with a CTDEP order to remove ammonia-nitrogen from the plant effluent in order to obtain a Class B water quality standard, the town of Vernon has plans to upgrade the VSTP. The upgrade project is now in the design phase, however permitting and funding constraints could result in implementation being delayed for several years.

Agricultural runoff also represents a significant percentage of the pond's inflow. Discharge of industrial cooling water is minimal. The main source of nonpoint agricultural loading is farming activity in the Ellington Valley. Farms in this part of the basin drain into Marsh Brook, a tributary of the Hockanum. Marsh Brook, which enters the Hockanum about 1.5 miles above the VSTP, has a drainage area of about 5 square miles..

Water quality testing was undertaken as part of this study in June 1989. Water samples were taken from the Hockanum River's inlet to the pond, at about mid-pond and from the spillway vicinity. The samples were tested for a variety of heavy metals and nutrients. Elevated levels of copper and cadmium were found, but these levels were not determined to be a health threat.

Union Pond is classified by the state as a shallow, eutrophic warmwater pond. The Connecticut Department of Environmental Protection reports that there have been numerous fishkills in recent years. A July 1977 field survey by DEP showed dissolved oxygen (DO) levels of less than 0.1 ppm in water depths greater than about 6 feet. The pond also experiences high nutrient lev-

els and occasional coliform bacteria contamination. Due to these factors the Hockanum River, including Union Pond has been designated a ''water quality limited'' segment pursuant to Section 303 of the Pollution Control Act of 1972, PL 92-500, as amended.

Existing Use and Development

Most of Union Pond's shoreline is undeveloped. A public cemetery and a town-house development occupy the southeastern shore. A 6-acre public park, residential area and the dam occupy the southwestern shore. More residential development occupies the lower third of the northwestern shore. The prposed 25-acre public park site and a sand and gravel pit occupy the remainder. The Hockanum River enters the pond from the northeast.

The poor water quality of Union Pond discourages most uses, but some boating activity does occur, particularly in the spring when higher flows temporarily improve its water quality. This boating activity is limited in the most part to canoes and occasional sailboards. Some sport fishing also occurs, although numerous fishkills in recent years have discouraged this use. Due to bacteria levels elevated beyond those allowable for swimming, particularly during storm runnoff periods, swimming is not a common occurrence.

Local Improvements

In addition to the Union Pond Dam itself, the town of Manchester has acquired much of the pond's shoreline. A 6-acre parcel at the ponds southeast corner has been developed as a public park. A dirt boat ramp and a diked winter ice-skating rink have also been constructed at this site. The rink is not often used due to the dike's pervious nature resulting in its inability to retain water for extended periods. Utility poles with outdoor lighting have been placed about the rink and could serve as a basis for lighting any boating facility at this site. A dirt parking area is located adjacent to the boat ramp. However, paved areas would be necessary to support the degree of use contemplated by the town if deepening of the pond were to be accomplished.

The town has also acquired a 25-acre parcel, which was a former sand and gravel pit, located at the northwest corner of the pond. The town plans to develop this area as a public park with a variety of recreational use facilities, including navigational

access planned. Navigational access and deepening of adjacent areas of the pond is viewed by local officials as necessary to support the park development plan.

The town also owns other shorefront parcels, most notably the cemetery along the eastern shore. As part of the linear park proposal the town would establish trails and bike paths along one or both shores of Union Pond.

FUTURE CONDITIONS (WITHOUT PROJECT CONDITION)

Water quality at Union Pond is primarily affected by upstream point and non-point sources of pollution and would not significantly improve with or without dreging unless the upstream sources are significantly curtailed. However, the town believes that the contaminated sediments of the upper reaches of Union Pond are a significant enough contributer to the pond's poor water quality that recreational use of the pond would not occur without their removal. The development of navigational access at the proposed northwest park site would not be workable without dredging of the upper reaches. The areas proposed for dredging comprise about one third of the pond's area and a good portion of its overall length. Enlarging the area of the pond usable for navigation, in the abscence of other factors, would provide an expanded capacity for boating use.

The town is expected to continue with plans to develop the new northeast park site and the linear park with or without navigation improvments. Provisions for navigational access facilities and dredging of the pond would allow for an additional type of recreational use to occur, increasing the overall recreational use of the area.

It is reported that construction of an upgraded wastewater treatment facility at the VSTP can be expected to occur within the next decade. This should lead to greatly improved water quality in the downstream areas of the Hockanum River, including Union Pond. However, non-point introduction of nutrients through agricultural runoff may still prevent achieving optimum water quality conditions at the pond. Recreational use of the pond, in terms of navigation, fisheries and shoreside activities can only be expected to increase once the VSTP upgrading occurs.

PROBLEMS AND OPPORTUNITIES

The problems inhibiting recreational navigational use of Union Pond are threefold.

- Poor water quality due to lack of adequate wastewater treatment at upstream facilities, leaching of historic contaminants from pond bottom sediments and upstream areas, as well as agricultural runoff.

- Lack of avilable improved public access facilities on Union Pond.

- The limited surface area of the pond available for safe navigation due to restricted depth.

Dredging, as requested by local officials, would provide deeper water in the upper pond. This would allow navigational access to upstream areas and the facilities the town proposes to construct at the northest park site. It would thus allow boating use of the pond's upper reaches and potentially reduce contaminent leaching into pond waters from contaminated bottom sediments in the upper pond.

Such improvements would benefit recreational navigation users of the waterway. No commercial navigation use would occur. No other benefits soley attributable to increased depth and shorefront access could be expected to occur.

PLANNING CONSTRAINTS AND CONCERNS

Planning constraints are conditions, either natural, man-made or institutional which limit the scope of the plan formulation process by imposing restrictions on the scope of potential solutions. For this reconnaissance level of investigation, two planning constraints have been identified. A number of other concerns have also been identified which will require more detailed analysis in any subsequent planning stages as they may be shown to constrain final plan formulation.

One constraint concerns the consideration of Union Pond as part of the area's existing inland navigation system. The nearest existing navigation channel is the Connecticut River Channel which provides access from Long Island Sound upstream to Hartford, Connecticut. The Hockanum enters the Connecticut at East Hartford below the upstream limit of this channel. To provide

continuous navigation from the Connecticut River to Union Pond would be prohibitively expensive. Five dams cross the Hockanum below Union Pond, as do 14 bridges. These bridges include a Conrail line, two crossings of Interstate 84 and US Routes 5, 6 and 44. Major highway alterations and the construction of several lock and dam structures would be necessary to secure continuous navigation upstream to Union Pond. Existing conditions therefore constrain consideration of Union Pond as a part of the region's inland navigation system.

The second identified planning constraint is the present degraded water quality condition. This condition is due to primarily to upstream point and non-point sources of pollution. This constrain future use of the waterway, particularly as it relates to likely undesirable water quality for water based recreation, such as swimming and fishing. Although curtailment of upstream point source pollution is planned, no imminent change in this source is forseen.

Among the concerns identified at this reconnaissance stage of study is the condition of the Union Pond Dam itself, which is owned and maintained by the Town of Manchester. The dam was the subject of an inspection report prepared as part of this study and included as Appendix C to this report. Altough the repairs made by the town in 1988 contributed to the dam's current integrity, significant work still needs to be accomplished before the structure's unsafe geotechnical rating can be changed. Such additional repairs and rehabilitation would be necessary to ensure both the dam's integrity and any planned navigation improvement's viability. The continued maintenance of the dam would be necessary for the long term success of any navigation project at the pond.

The nature of the sediments which the town desires to have removed is also of concern. In the past, the Hockanum River was the site of numerous textile and paper mills, tanneries and other water and water power dependent industries, particularly in Rockville, a community upstream of Union Pond. These industries are likely to have discharged a variety of contaminants into the Hockanum River. Such contaminants could have been trapped to some extent by the dam, deposited on the bottom of the pond and incorporated into the existing sediments. Sediment quality is potentially the greatest variable in project feasibility due to its impact on disposal alternatives and thus on project cost. Bulk sediment testing conducted as part of this study revealed

elevated levels of a variety of heavy metals and other parameters of concern. Additional testing would be required to more accurately determine what impacts, if any, would result from the excavation and upland disposal of this material. For the purpose of this analysis it was assumed that the material was acceptable for use as cover at existing upland landfill sites.

The state Historic Commission has agreed with the Corp's assessment that the submerged former floodplain area proposed for excavation may contain prehistoric archaeological sites. Due to its proximity to the river and its potential for agricultural use, the area may have supported habitation sites in precolonial times. An archaeological survey, at a minimum to consist of core sampling and analysis, would need to be conducted during any subsequent preconstruction planning.

Construction should be scheduled so as to result in a minimum impacts to fisheries and other wildlife using the pond and river. Drawing down the pond for excavation would have to be conducted gradually so as to avoid fish strandings in those pools isolated by the dropping water level. A fish salvaging operation may be necessary if future studies show that the pool remaining in the lower reaches after drawdown could not support the fish population. The lower pool's ability to maintain adequate dissolved oxygen levels with the pond in a drawn down condition during the construction period will have to be assessed. Additional construction impacts on the remaining lower pool, such as turbidity and resuspension of contaminated sediments, need to be addressed as well.

PLANNING OBJECTIVES

Planning objectives which addressed the problems, needs and opportunities as identified above were developed.

- Allow for the development of safe and efficient public recreational access to Union Pond for navigational purposes during the 1995-2045 period of analysis.

- Contribute to improvement in the water quality in Union Pond in support of expanded recreational use of the waterway during the 1995-2045 period of analysis.

PLAN FORMULATION

Consideration of the problems, needs and opportunities in the study area has led to the formulation of a possible solution for evaluation. For the reconnaissance level of study, only the most likely solutions to the various problems were considered, to determine the Federal interest, if any, in implementation of a plan of improvement, and as a prerequisite for further Feasibility Stage studies. The plan of improvement was designed to achieve the planning objectives stated previously. The objectives of the non-Federal sponsor, the town of Manchester, were also considered in the formulation and evaluation of alternative plans.

MANAGEMENT MEASURES

Management measures can generally be catagorized as either structural or nonstructural solutions. In the formulation of alternative plans, a broad range of solutions can be identified to address one or more of the planning objectives. Structural solutions generally involve construction of physical features which would address the planning objectives at the project site, or at another site outside of the area. Nonstructural solutions would involve the achievement of the planning objectives without the need for construction of physical features.

Nonstructural Measures

The sponsor's desire is for development of waterside recreational facilities to include navigational activities. The town of Manchester has selected Union Pond as the most likely site within the community for such development. To this end, the town has already aquired much of the pond's shorefront land for development of public parks and water access.

Within the town of Manchester, there are other water bodies exist which could be developed for these purposes. Only two of the town's other water bodies are of comparable size to Union Pond, sufficient to allow the level of public recreational use desired. The first of these, Laurel Lake, is located on the Hockanum River downstream of Union Pond. Laurel Lake is about twice the size of Union Pond and public shorefront does exist. The eastern half of the lake is bounded by some of the town's largest wetlands. A sewage treatment facility occupies the southeast shore, while the town's landfill is located east of the

wetlands. Interstate highways occupy the north and west shores. While of sufficient size, the general lack of depth, presence of extensive wetlands and existence of noncompatible activities along the shore, make development of Laurel Lake for recreational navigation impractical.

The Globe Hollow Reservoir is the only other water body of sufficient size within town limits. However, as a public water supply reservoir, development of recreational navigation at this site would not be compatible with its present use.

Neighboring towns do offer water bodies of greater size which could be developed. To the east, in Vernon and Bolton, are the Bolton Lakes, a string of three dammed water bodies. The lower two lakes together have an area more than six times that of Union Pond. Residential properties occupy more than half the Lakes' shorefront, however, more than enough shore remains available for development of public facilities in addition to those already in use.

Shenipsit Lake, the source of the Hockanum River, is located northeast in Vernon, Tolland and Ellington, above the village of Rockville. The lake is more than eight times the size of Union Pond and is a water supply reservoir. It's water supply use makes development of recreational boating facilities undesirable.

Development of recreational navigation facilities in areas outside the town of Manchester, although possible, would not be supported by the non-Federal sponsor. Within the town of Manchester, the only water body of sufficient size available for development and unencumbered by other existing uses is Union Pond. Considering the lack of local sponsor and user support for development of facilities outside of Manchester, alternatives involving development at sites other than Union Pond were dropped from further consideration.

Structural Measures

Possible structural improvements were identified to address specific planning objectives within the Union Pond project site. The dredging of the upper pond area, to provide greater room for boating as well as reduce a contributing source of poor water quality, would encourage recreational use of the waterway. The non-Federal sponsor would need to construct necessary shore facilties to support the desired level of recreational navigation usage. Such facilities could be built at a number of sites along the pond's shore.

PLAN FORMULATION RATIONALE

The various regulations, circulars and manuals used to direct the implementation of Federal water resources improvement programs, establish a standard set of criteria to guide the formulation, design and evaluation of alternative solutions to the problems identified in any study. These criteria permit the development and selection of the plan of improvement which best responds to the planning objectives.

As stated earlier, two principal town-owned properties exist at Union Pond, the 6-acre southeast park and the 25-acre northwest park. An existing dirt boat ramp and dirt parking area are located at the southeast park. The northwest park is currently an undeveloped former sand and gravel pit and wooded area. In order to support the level of navigation dependent use envisioned for Union Pond, an improved boat ramp and parking area for cars and trailers would be needed. The existing access facilities are not sufficient for the volume and intensity of use expected.

Construction of a paved boat ramp could be accomplished at either site. With average use expected at about 70 launches per weekend day, and more on peak days, the land area available for development of an improved parking area is available at the smaller southeast park, but not without eliminating most current uses. It may be desirable for the community to construct improved public access facilities at both parks, although only one access site is necessary to achieve the expected level of use.

Of Union Pond's existing 52 acres, only about 35 are of sufficient depth to allow boating. During the average expected 70 boat level of use, this would equal about 2 boats per acre of pond, indicating a very crowded condition. Increasing the area available for navigation would allow greater room per boat and contribute to safer navigation.

FORMULATION OF ALTERNATIVES

For this level of study, a single plan consisting of excavating the upper reach of Union Pond and adjacent areas was evaluated. This plan was proposed by the project's non-Federal sponsor. Depths of 5, 6, 7 and 8 feet below the spillway crest elevation (BSE) were evaluated. The 5-foot depth was considered the minimum depth for small boat and sailboard navigation. Swimming, water-skiing and other uses were not evaluated in this report due to questionable with-project water quality. These activities, expressed as desirable by local officials, would require greater depths. No aids to navigation would be required.

The proposal as evaluated would involve the excavation of about 15,700 cubic yards of ordinary material to create a minimum depth of -5 feet BSE. The material would be removed from the upper third of the pond, in an area assumed to be the remnant pre-1901 floodplain. A smaller shoal area along the western shore at about mid-pond would also be removed to a depth of about 5 feet BSE. Due to the steep nature of the pond's bank, the toe of the slope would be about 50 feet from shore. This is necessary to allow a side slope of 1 on 3, without impacting the stability of the bank. The evaluated plan is shown in Figure 3.

EXCAVATED MATERIAL DISPOSAL OPTIONS

Disposal of the excavated material is presently the greatest variable in determining the cost of this project. Testing revealed the presence of several contaminants in the material proposed for excavation. The impact of this contamination on the range of acceptable disposal options and construction methods has not been evaluated. Further testing would be necessary to make a such determinations.

For the purpose of this reconnaissance level of study, it was assumed that the material to be excavated would be shown to be acceptable for use as cover at a nearby upland landfill site. The originally proposed northwest park site was determined to be inadequate to contain leachate from the disposed material, which could readily re-enter the pond due to the porous sandy nature of the substrate at that site. Additional groundwater studies could show this site to be acceptable provided some form of containment such as clay and/or plastic liners together with adequate capping are used. However, such methods would be costly.

Several existing landfill operations in the immediate area could stockpile the material for use as daily cover or as a final cap, should a facility be scheduled for closure near the time this project is constructed. The three facilities closest to the project site are located in Manchester and the neighboring towns of East Windsor and East Hartford. Additional testing would be required to determine the dredged material's suitability for such disposal options. The cost of disposal for the dredged material will represent a significant part of the project's cost.

The three identified landfills are all within a 7 mile haul of the project site. The closest is located next to Laurel Lake through which the Hockanum River flows, downstream of Union Pond, about 4.6 miles from the project site. The facility is located behind the town of Manchester's wastewater treatment plant. The

CONTROL POINTS

MH13 N 354310.69 E 661796.40
MH14 N 354034.15 E 661653.87
MH17 N 353396.58 E 661247.80
MH18 N 353227.09 E 661015.73
TR1 N 351996.08 E 660912.36
TR2 N 354316.06 E 662216.00
TR3 N 353394.59 E 661247.75
TR4 N 352149.61 E 660329.08
TR5 N 353608.40 E 661145.66
S24 N 354604.98 E 662178.70

NOTE: ELEVATION REF.
APPROX. N.G.V.D. OF 1929
TOP OF SPILLWAY ELEV.=142.3

NOTE: HORIZONTAL CONTROL IS BASED ON THE STATE OF CONNECTICUT COORDINATE SYSTEM.

N

5 FEET BSE

AREA EXCAVATED TO 5 FEET BSE

NAVIGATION PROJECT LIMITS

UNION POND DAM
TOP OF SPILLWAY
ELEV. =142.3

M.H. 18 CONTROL PT
DRILL HOLE FND

M.H. 17 CONTROL PT
DRILL HOLE FND
HELD FOR POSITION

PROPOSED NORTHWEST PARK SITE

M.H. 14 CONTROL PT
DRILL HOLE FND

M.H. 13 CONTROL PT
DRILL HOLE FND
HELD FOR LINE

S 13°29'09" W
1438.17

S 46°25'04" W
1396.71

N 29°19'56" E
2661.18

HOCKANUM RIVER INLET

DIRT BOAT RAMP

EXISTING SOUTHEAST PARK

CEMETERY

Scale 1" : 100'

NOTE: Shoreline and old Hockanum River channel and other upper pond bottom features taken from town of Manchester Sectional Map, dated March 1958.

ARMY CORPS OF ENGINEERS
JOB #2252
CONTRACT NO. DACW.33-88-D-0003
Dunn Engineering CO.; INC.
Delivery Order No. 12

UNION POND
MANCHESTER CONNECTICUT
DATE: JUNE 29,1989
WORKING PLAN
SHEET #1 OF 9

EVALUATED PLAN
OF IMPROVEMENT

FIGURE 3

second is located adjacent to the north bank of the Hockanum River in East Hartford, further downstream, about 6.5 miles from the project site. The third is located in East Windsor, about 7 miles north of the project site at an old gravel pit. The locations of the three sites are shown in Figure 4.

Of the three sites, the two located downstream along the Hockanum are not likely candidates, as they lie adjacent to wetlands bordering the river. these sites present the same problems with the potential for reintroduction of contaminents to the river as the originally considered waterfront park site. For the purposes of this analysis therefore, the East Windsor site will be used to develop cost estimates.

EVALUATION OF ALTERNATIVES

This section presents the alternative plan of improvement selected for evaluation. Evaluation was based on the plan's impact on the without-project condition, including economic impacts such as project costs and benefits, impacts on the environment, public views and sponsor support, and contribution to the planning objectives.

PROJECT COSTS

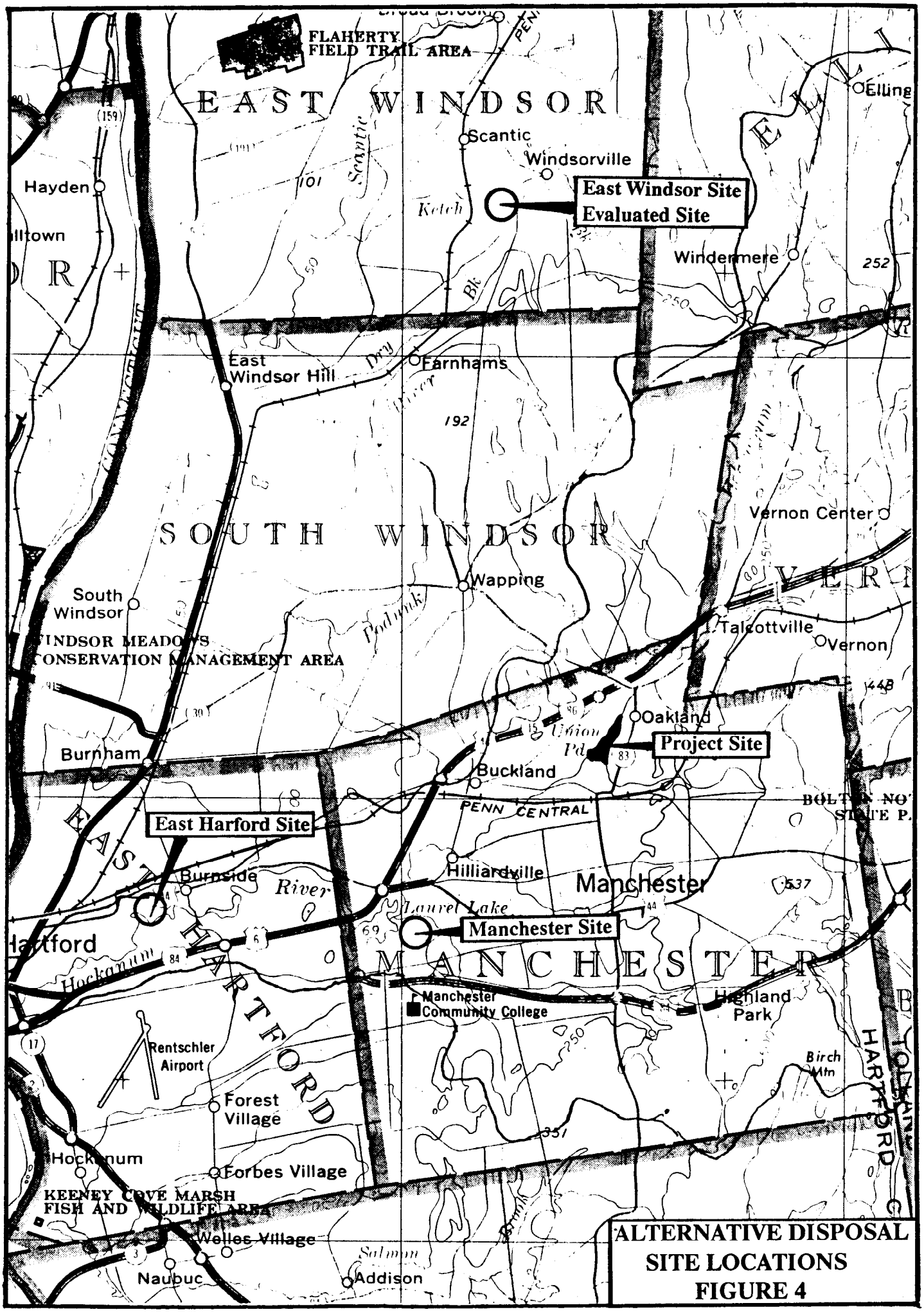
The plan under evaluation consists of excavation to form general navigation features (GNF) and construction of local shore support facilities. Excavation for the evaluated plan would involve ordinary material; silts, sands, gravels and cobbles. The material would be removed by various equipment, most likely a front-end loader, placed in trucks, and hauled 7 miles north to the disposal site, a currently active landfill operation in East Windsor. No overdepth allowance is included in the quantity estimates as excavation elevations can be accurately achieved with the use of land equipment. Quantity estimates include the formation of side slopes of one-on-three.

Annual costs include maintenance of both the GNF and the local shore facilities. Maintenance of the excavated areas would be required periodically over the project life in order to maintain design depths. The pond would be subject to siltation and shoaling of material derived from upland erosion. For the purposes of this evaluation, a shoaling rate equal to four percent of the improvement quantity, per year, has been used to determine annual maintenance costs. The implementation costs and annual costs for the evaluated plan of improvement are shown in Table 1.

TABLE 1
RECONNAISSANCE REPORT
HOCKANUM RIVER AT UNION POND
PROJECT COSTS

Project Depth - 5 Feet Below Spillway Crest Elevation

FIRST COSTS	
GENERAL NAVIGATION FEATURES	
Excavation & Disposal	
cubic yards	(15,700)
Cost (at $10.30/cy)	$162,000
Contingencies	41,000
Subtotal	$203,000
Engineering & Design	19,000
Supervision & Administration	28,000
TOTAL FIRST COST GNF	$250,000
CONSTRUCTION PERIOD	< 1 Month
(Interest During Construction)	(Nil)
NON-FEDERAL IMPROVEMENTS	
Paved Parking Area	$ 44,000
Paved Boat Ramp	36,000
Potable Water Service	1,000
TOTAL	$ 81,000
TOTAL PROJECT COST	**$331,000**
ANNUAL COSTS	
General Navigation Features	
Interest & Amortization	$ 22,500
Maintenance Dredging	6,500
Total GNF	$ 29,000
Non-Federal Improvements	
Maintenance	$ 800
Interest & Amortization	7,300
Total Non-Federal	$ 8,100
TOTAL ANNUAL COST	**$ 37,100**



ALTERNATIVE DISPOSAL SITE LOCATIONS
FIGURE 4

ECONOMIC ANALYSIS

The evaluated plan provides benefits to recreational navigation interests. Benefits would accrue in the form of increased value of recreational time and new recreational time realized by users of the pond after improvements. Benefits were computed at June 1989 prices and a 1989 Federal interest rate of 8 7/8 percent. A summary breakdown of annual project benefits for the four plans is provided in Table 2.

Excavation would enlarge the area of the pond available for recreational boating activity. Removal of the material would also reduce one source of poor water quality. This would result in an increase in the present value of recreational experience of the pond's existing users as they would be able to enjoy the use of the whole pond with possibly cleaner waters instead of being limited to use of the lower reaches. The improvement in the value of the boating experience would also attract new boating users to Union Pond.

Since water quality is primarily impacted by upstream sources of pollution, project excavation would not likely improve water quality to the point of allowing an upgrade in the river's water quality classification. Additional recreational uses such as swimming and fishing are not likely to occur as a result of a navigation project alone. Any substantial improvement in water quality would be dependent on the upgrading of the VSTP. Curtailment of nutient loading from upstream agricultural areas will also be necessary to achieve optimum water quality conditions. Project benefits were, therefore, not evaluated for improvements to water quality, use of the pond for swimming or development of recreational fisheries.

The recreational boating season for this area of the state is estimated to be about 19 weeks, from mid-May to September. Based on a survey of similar small lakes with launching facilities, it is estimated that use of Union Pond during the boating season would average about 20 launches per weekday and 70 launches per weekend day, for a total of about 4700 potential launches per year. About 514 of these annual launches were estimated as the existing level of use. Of this number, it was assumeed that 25 percent would be prevented by poor weather. The pond would likely be used by canoes, sunfish and other small sailboats, rowboats and sailboards. On average it was assumed that each craft would carry 1.5 passengers. Details of the economic impacts of the project are contained in Appendix F - Economic Analysis.

TABLE 2
RECONNAISSANCE REPORT
HOCKANUM RIVER AT UNION POND
ECONOMIC BENEFITS SUMMARY

SEPARABLE RECREATIONAL BENEFITS

Existing Recreational Fleet	
Increased Recreational Value	$ 900
New Recreatioal Boaters	
New User Day Value Realized	$16,900
TOTAL BENEFITS	**$17,800**

ECONOMIC JUSTIFICATION

One factor in determining Federal interest in a given project is economic justification. To be considered economically justified, a project's, or a plan's benefit-cost ratio must be greater than or equal to one. Table 3 shows a comparison of the annual costs and annual benefits of the evaluated plan and the plan's benefit-cost ratio.

TABLE 3
HOCKANUM RIVER AT UNION POND
RECONNAISSANCE REPORT
COST-BENEFIT ANALYSIS

(Excavate to 5 Feet Below Spillway Crest Elevation)

Annual Benefits	$17,800
Annual Costs	$37,100
Net Annual Benefit	None
Benefit-Cost Ratio	**0.48**

Since the annual cost of the evaluated plan exceed the project's annual benefits, the benefit-cost ratio is less than one, and no net benfits are produced. The evaluated plan of improvement is therefore not economically justified.

ENVIRONMENTAL FINDINGS

At this reconnaissance level of study, initial coordination was carried out with Federal and state resource agencies and local officials concerning environmental issues and concerns relative to the project. These reconnaissance level investigations are described in detail in Appendix E - Environmental Analysis. Impacts on water quality, biological communities and archaeological resources as well as issues relating to the degree of contamination of the material to be excavated, were of principal concern.

The excavation itself should not significantly alter water quality, neither adversely during construction, nor in a positive manner after construction. The present water quality and the principal source of contamination, the VSTP, will continue to influence the recreational potential of the waterway. Contact recreational activity such as swimming may not be advisable until such time as the VSTP is upgraded. The health risk from plant effluent will, therefore, limit project benefits and the continued non-point nutient loading from agricultural runoff will hamoper achieving optimum water quality conditions.

The change in bottom topography and development of shore facilities will impact the fisheries at the pond. The change in substrate in the upper pond will direct the benthic population to adapt and restructure to the new topography. Foraging fish may have to adapt to new benthic prey.

Minor wetlands along the pond's periphery will need to be delineated and impacts of the project on these areas assessed. An evaluation would be required for the project under Section 404(b)1 of the Water Quality Act of 1974 before the project could be constructed. Aquatic plant control strategies may need to be developed to ensure safe navigational use, particularly if the use of small motorcraft is contemplated.

Impacts on existing fish populations as a result of construction activities would need to be assessed. Fish stranding potential and the possibility of fishkill during a pond drawdown period may require a fish salvaging program. If fisheries development is contemplated by the town to support future activities, a fisheries stocking program and management plan would need to be developed.

Analysis of the material to be excavated revealed the presence of several contaminants which could limit disposal options. The physical nature of the material makes it unsuitable for resale as fill or construction material. Additional testing would be required to assess likely disposal methods.

The proposed excavation would have no impact on historic period sites. Evidence of prehistoric activity may, however, be present in the submerged floodplain and would require further examination.

Initial coordination has revealed no environmental issues which at this time could be viewed as unresolvable. Impacts to fish and other populations in areas to be excavated are considered to be minor. Consultation under the Endangered Species Act should not be required. A more detailed examination of these communities, the sediment to be excavated and potential disposal options would have to be made in more detailed study stages.

LOCAL VIEWS AND INVOLVEMENT

The town of Manchester requested this study of improvements to the Hockanum River at Union Pond in their by letter, of May 24, 1988. Several meetings with town officials have been conducted to solicit local views. A meeting with held on January 18, 1989 provided local interests an opportunity to describe in detail the problems encountered with navigation and related activities at Union Pond and to give these parties input into the planning process. On June 1, 1989, the alternative being examined and the potential impacts indentified for each, were presented to local officials and representatives of state resource agencies during a visit to the project. Local officials have expressed support for the proposed plan of improvement.

FINDINGS REQUIRING FURTHER STUDY

Should non-Federal interests desire to continue study of navigational improvements to the Hockanum River at Union Pond, extensive additional studies of the proposal would need to be conducted. An environmental assessment would need to be prepared to address the issues discussed earlier concerning excavation, disposal, water quality, dam safety, waterway use, construction of shore facilities and waterway maintenance.

Sediment sampling and testing would need to be conducted. Testing should include EPA's extraction procedure toxicity tests,

EPA tests for volatile organic compounds - Schedule 8010, 8015 and 8020. A study of sediment influx rates, siltation and sources of sediment, and likely future sediment quality, would be necessary to predict maintenance dredging frequencies and establish management measures to control or limit siltation and identify maintenance disposal sites. Biological testing may be required. Wetlands impacts and impacts on fisheries and other populations would need to be addressed.

A detailed study of water quality, including dissolved oxygen levels, should be conducted to determine construction impacts on fisheries. The study should also address the effects of future improvements in upstream point and non-point sources of pollutional discharges in enhancing aquatic habitat and recreational opportunities at Union Pond.

Potential disposal sites would need to be surveyed to determine their capacity and permitted capability to accept disposal of the material to be excavated. Potential sites may have to be studied to determine impacts at the sites. Groundwater studies may have to be conducted at the disposal site if it is determined that contaminants in the excavate have the potential to leach into surrounding areas. Site preparation to ensure containment may have to be examined.

The continued poor condition of the Union Pond Dam would require examination in detail, particularly from a geotechnical view point. Additional repairs would have to be made to ensure the safety of the structure and the long-term benefits to pond users. Specific recommendations concerning additional repairs to the dam are detailed in Appendix C, page C-20.

An archaeological investigation of the proposed excavation area should be accomplished. Soil profiles would need to be conducted to examine the area for any intact prehistoric land surfaces. An archaeological survey may be required if soil profiles exhibit considerable archaeological integrity.

The ability of the waterway to support various recreational uses has to be assessed for conditions including and not including the upgrade of the VSTP. Management measures for controlling upstream agricultural runoff and resultant nutrient loading at Union Pond need to be examined. Findings concerning the ability to manage nutrient loading should be included in any aquatic plant management program.

Subsurface explorations would need to be conducted to determine the nature of the material to be removed at depth. This will be necessary to more accurately determine engineering feasibility and excavation methods and costs. Such an exploration program would consist of borings and probings over the areas to be excavated.

Coordination of further studies should be conducted with the Connecticut DEP, Solid Waste Division, Fisheries Bureau, Water Compliance Division, the state Historical Commission and other appropriate state and local agencies. A Corps of Engineers permit for dredging and disposal, and for construction of shore facilities having navigational impacts will be required before construction. As part of this process, Federal resource and permitting agencies, including the Corps' Regulatory Branch, EPA and the U.S. Fish and Wildlife Service will have input to the project.

An Environmental Assessment should include the results and analyses of the above tests and studies. The assessment should be used as a basis for local, state and Federal permit and license applications.

CONCLUSIONS

The problems with navigation at Union Pond have been studied at the reconnaissance level. A preliminary plan of improvement to alleviate these problems has been formulated and evaluated. Based on this level of analysis, an engineeringly feasible, and environmentally acceptable potential solution to some of these problems has been developed. This plan would involve excavation of the upper third of Union Pond and adjacent areas to a depth of 5 feet below the spillway crest elevation. The economic benefits resulting from this plan, all due to recreational navigation use of the waterway, do not offset project costs. There are no net benefits to the evaluated plan, and therefore the project is not economically justified. Federal participation in further study efforts is not possible.

RECOMMENDATION

As Division Engineer, New England Division, Corps of Engineers, I find that Federal participation in further studies of navigation improvements for the Hockanum River at Union Pond, Manchester, Connecticut, for the purpose of recreational navigation is not warranted at this time.

Daniel M. Wilson
Colonel, Corps of Engineers
Division Engineer

ACKNOWLEDGEMENT AND IDENTIFICATION OF PERSONNEL

This report was prepared under the supervision and management of the following New England Division personnel:

Colonel Daniel M. Wilson, Division Engineer
Joseph L. Ignazio, Chief, Planning Division
Nicholas E. Avtges, Chief, Plan Formulation Branch
John T. Smith, Chief, Coastal Development Section

Study management, plan formulation and design of the channel and anchorage features of the project were conducted by the Project Manager, Mark Habel. The environmental analyses and appendix were prepared by William Hubbard and Kirk Bargerhuff. Water and sediment quality analyses were conducted by Jon Szarek. The dam inspection report was prepared by Chuck Wener, Jon Szarek, Dave Descoteaux and Paul Schimelfenyg. Quantity and Cost Estimates were by Robert Simeone. Cultural resources analysis was by Kate Atwood and economic analysis was by Karen Fredrickson.

HOCKANUM RIVER
AT UNION POND
MANCHESTER, CONNECTICUT

NAVIGATION IMPROVEMENT STUDY

RECONNAISSANCE REPORT

APPENDIX A

PERTINENT CORRESPONDENCE

HOCKANUM RIVER,
CONNECTICUT

APPENDIX A

Pertinent Correspondence

LIST OF PUBLIC MEETINGS
HEARINGS AND WORKSHOPS

January 18, 1988 - Meeting with local officials and Congressional Staff - Manchester Town Planning Office

June 1, 1988 - Meeting with Local Officials and Congressional Staff - Manchester Town Offices

HOCKANUM RIVER AT UNION POND
MANCHESTER, CONNECTICUT

APPENDIX A
SECTION 1

COPIES OF CORRESPONDENCE
RECEIVED DURING REVIEW OF DRAFT REPORT

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02254-9149

REPLY TO
ATTENTION OF

CENED-PL-C (1105-2-10) 12 January 1990

MEMORANDUM FOR: COMMANDER, USACE (CECW-P), 20 Mass., Ave., N.W., Wash, DC 20314-1000

SUBJECT: Reconnaissance Report - Hockanum River at Union Pond, Manchester, Connecticut - Navigation Improvement Study, CWIS #87635

1. In accordance with EC 1105-2-189 dated 31 January 1989, as amended, the subject report has been completed and is submitted for approval. Enclosed are ten (10) copies of the Reconnaissance Report and ten (10) copies of the Fact Sheet.

2. Federal assistance was requested by the town of Manchester, Connecticut. Reconnaissance efforts began in February 1989. The project evaluated involved deepening a portion of Union Pond for recreational navigation purposes. The local sponsor has reviewed and commented on the report (copy of letter attached). The report recommends no further Federal involvement due to a lack of economic justification.

DANIEL M. WILSON
Colonel, Corps of Engineers
Commanding

Enclosures

Town of Manchester

41 Center Street

Manchester, Connecticut 06040

RICHARD J. SARTOR, GENERAL MANAGER

THEUNIS WERKHOVEN, MAYOR
SUSAN BUCKNO, DEPUTY MAYOR
RON OSELLA, SECRETARY

DIRECTORS
STEPHEN T. CASSANO
PETER P. DiROSA, JR.
JOYCE G. EPSTEIN
JAMES F. FOGARTY
WALLACE J. IRISH, JR.
ELLEN BURNS LANDERS

December 22, 1989

Colonel Daniel M. Wilson
Department of the Army
Corps of Engineers
Planning Division
New England Division
424 Trapelo Road
Waltham, MA 02254-9149

Re: Hockanum River at Union Pond - Reconnaissance Report

Dear Colonel Wilson:

I have recently completed my review of the Hockanum River Union Pond Navigation Improvement Study report dated November 1989. While we are naturally disappointed that the Corp has determined that there should be no further federal participation in this project, the report contained valuable information which I am sure the town and its consultants will find useful in pursuing recreational development of the Union Pond.

I would like to offer the following comments regarding the draft report:

- On page 9 of the draft the second paragraph states that "The town also owns other shore front parcels, most notably the cemetery along the eastern shore." This statement is erroneous. The cemetery parcel on the eastern shore is owned by the Catholic Cemeteries Association. We are negotiating with the Association for permanent access easement rights for the Hockanum River Linear Park trail system.

- The last paragraph on Page 13 identifies Laurel Lake as one of two major water bodies in Manchester comparable in size to Union Pond. In fact, Laurel Lake was created by an impoundment structure which was breached at least 10 to 15 years ago. It is now more accurately described as Laurel Marsh and the Hockanum River meanders through former lake bed.

I have forwarded the reconnaissance report to our director of Public Works and advised him of the deadline within which he must submit comments to you.

Sincerely,

Mark Pellegrini
Director of Planning

cc: Peter Lozis, Jr., Director of Public Works

MP:pgw

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02254-9149

REPLY TO
ATTENTION OF

November 30, 1989

Planning Division
Plan Formulation Branch

Mr. Robert B. Weiss, Town Manager
Town of Manchester
Municipal Offices
41 Center Street
Manchester, Connecticut 06040

Dear Mr. Weiss:

Attached is the draft Reconnaissance Report for the Hockanum River at Union Pond, Manchester, Connecticut, Navigation Improvement Study. The Reconnaissance Report concludes that Federal participation in navigation improvements at Union Pond are not justified.

This study was conducted under the authority of Section 107 of the River and Harbor Act of 1960, as amended. The study evaluated a plan to excavate the upper reaches of Union Pond to a depth of 5 feet below the spillway crest elevation of the Union Pond Dam. Such a plan would have encouraged expanded recreational boating usage of the pond and complemented town plans to develop a public park with waterfront access along the pond's northwest shore. The cost of the improvement was estimated at $250,000 for excavation and disposal, and $81,000 for improvement of public waterfront access.

The project would produce annual benefits of $17,800 to recreational boaters using an improved pond. These benefits, compared to annual costs of $37,100, yield a benefit-cost ratio of 0.48. Due to a lack of economic justification, I have determined that no further Federal involvement in navigation improvements to the Hockanum River at Union Pond, is warranted.

Although there is no justification for Corps participation in any improvements, there is included in the report information on water quality, dam safety and sediment chemistry that could be useful in your efforts to provide improved recreational opportunities at Union Pond.

Following your review of the report, a final document will be transmitted to the Office of the Chief of Engineers for review and approval. In order for your comments to be included in the report, they must reach me by 31 December 1989.

Should you have any further questions regarding this matter, please contact me at (617) 647-8220. Mr. Mark Habel, the project manager for this study, can be reached at (617) 647-8550.

Sincerely,

Daniel M. Wilson
Colonel, Corps of Engineers
Division Engineer

Attachment

HOCKANUM RIVER AT UNION POND
MANCHESTER, CONNECTICUT

APPENDIX A
SECTION 2

COPIES OF CORRESPONDENCE
RECEIVED DURING RECONNAISSANCE STUDY

STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION

June 22, 1989

Mr. Kirk Bargerhuff
U.S. Army Corp of Engineers
New England Division
424 Trapelo Road
Waltham, MA 02254

Dear Mr. Bargerhuff:

Enclosed is my assessment of the dredge project proposed for the upper section of Union Pond in Manchester, CT. The Bureau of Fisheries recommends that an environmental impact assessment of the proposed project be completed. The study should address dredge method(s) which would be the most appropriate for Union Pond. This study should also include a cost/benefit analysis which would explore the level of public utilization of this resource given continuing low water quality. Adverse impacts should also be investigated. These would include: (1) losses of fish cover and structure, (2) drawndown effects on fish and other forms of aquatic life, (3) disposal of sediments and contaminated sediments, and (4) an identification of point and non-point sources of pollution within the Hockanum River. The Department of Environmental Protection (CTDEP) should be provided an opportunity to reevaluate the proposed project following the completion and submission of the environmental impact assessment.

Site Description - Union Pond is an impoundment of the Hockanum River, approximately 65 acre in size. It is best characterized as a shallow and eutrophic warmwater pond. It contains one main basin that is estimated to be 6 meters deep. Nuisance amounts of filamentous algae are present throughout the growing season. Cloudy water conditions due to frequent algae blooms are common. The water quality of the pond and Hockanum River in this area is generally rated as poor; it is classified by the CTDEP as "CLASS C". The river has historically been the recipient of various toxic pollutants originating from upstream industry, agricultural operations, sewage treatment plants, and stormwater runoff. As expected, poor water quality conditions have resulted in numerous fishkills through the years. Unfortunately, Union Pond functions as a sediment and collection basin for all materials inputted to the Hockanum River. As I have mentioned in a previous correspondence, a field survey of Union Pond conducted in July 1977 revealed that waters greater than 2 meters in depth contained **less than 1 mg/l** of dissolved oxygen. Survey results indicated that dominant fish species are: bluegills (Lepomis macrohirus), white suckers (Catostomous commersoni), and golden

Phone:
165 Capitol Avenue • Hartford, Connecticut 06106

shiners (Notemigonus crysoleucas). Other documented fish species are: brown bullhead (Ictalurus nebulosus), common carp (Cyprinus carpio), white catfish (Ictalurus catus), and yellow perch (Perca flavescens).

Recommendations

To mitigate anticipated impacts, the following recommendations should be considered.

1. A "dry-dredge" methodology should be employed (pond level would be drawndown to expose dredge locations). A main concern in regards to fisheries impacts with dredging would be site runoff. It is important that dredged materials are not allowed to be introduced into water passing through the pond resulting in excessive turbidity and that spoils are disposed in a manner to prevent their leaching into the pond. This is of particular concern at this location since bottom sediments contain contaminants that should not be resuspended into the water column. Silt fences should be installed downslope of all areas that are actively being dredged and disturbed.

2. Another fisheries concern would be the potential for fishkills due to the lowering of Union's Pond water level. Lowering the pond's water level, especially in the summer, could result in minimal habitat that contains suitable dissolved oxygen levels for fish survival. Moreover, fish may become stranded in isolated pockets that are dewatered. It is recommended that temperature-dissolved oxygen profiles be determined during the summer in the main basin to obtain recent water quality information. Any pond drawdown should be done gradually to reduce the possibility of fish stranding. It would be prudent for the contractor to plan a fish salvaging operation.

If you have any questions regarding these comments, please give me a call. Thank you for the opportunity to comment.

Sincerely,

Brian D. Murphy

Brian D. Murphy
Technical Assistance Biologist
Connecticut Dept. of Environmental Protection
Fisheries Bureau
Eastern District Headquarters
Marlborough, CT 06447

STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Mr. Joseph Ignazio
Chief, Planning Division
Department of the Army
New England Division, Corps of Engineer
Waltham, Massachusetts 02254

June 20, 1989

Dear Mr. Ignazio:

In response to your letter of May 18th requesting comments concerning the proposed dredging of Union Pond, I would like to offer the following comments. At the time of the field review it appeared that the objectives of dredging the pond were not evident. Therefore, I feel the initial step in analyzing this project is to determine what is impeding recreational use of Union Pond.

The DEP has recommended dredging in cases were sediments have created an oxygen demand which were resulting in anoxic conditions within the water column. DEP has found dredging to be warranted in some instances were sediments are the origin of heavy metal or organic contamination in fish tissue. Sediment removal has also proving effective in reducing available habitat for nuisance aquatic weeds. If these conditions exist then perhaps dredging is a reasonable restoration technique for Union Pond. However, there appears to be a need for further investigation in order to justify a dredging restoration project to achieve recreational and water quality goals.

Once a clear understanding of the problem is reached, all restoration techniques applicable to this problem should be reviewed. Other methods could be less expensive or more effective and may merit consideration. If dredging is determined to be the most cost effective method, than background data should be reviewed to determine whether desired water quality will be achieved after the project is completed.

The Hockanum River receives waste from the Vernon Sewage Treatment Plant and is impacted from nonpoint source pollution. These sources of pollution may prevent full attainment of desired water quality goals and should be reviewed as part of the planning process for a restoration project. The wastewater from the sewage treatment plant is disinfected and should not create a health risk. However, it should be realized that at the point of discharge, during low flow periods, effluent from this facility comprises a significant amount of the total flow of the Hockanum River.

Stormwater runoff during and after rainstorms may elevate bacteria levels above the allowable limit for bathing. If swimming is desirable, than bacteria concentrations should be analyzed. If bacteria numbers are above the allowable limit for bathing then recommendations to reduce bacteria will need to be addressed.

Stormwater may also be depositing sediment into the pond from road runoff and erosive stream banks. Stabilizing these areas which are carrying sediment into the pond should be part of the overall project. If sedimentation of Union Pond is allowed to continue, the pond will fill-in after dredging and thus reduce the effectiveness of a costly restoration project.

Phone:

165 Capitol Avenue • Hartford, Connecticut 06106

If it is determined that nonpoint source pollution could prevent Union Pond from becoming a viable recreational resource then a watershed management plan should be incorporated into the restoration project. This plan should address correcting urban and agricultural nonpoint source pollution which may be accelerating eutrophication, creating a health risk, or depositing sediment in the lake.

When evaluating dredging as a restoration method it should be realized that disposal of dredge spoils may be an expensive cost to the project. The distance to the disposal site should be minimized if possible to control trucking costs. To determine eligible disposal sites sediments will need to be analyzed using the EPA extraction procedure toxicity test. Concentrations of water extractable metals from the sediments must be analyzed. If concentrations exceed EPA maximum contaminant levels for drinking water or limits imposed by the Connecticut Department of Health Services, disposal sites will be limited to areas approved by DEP Solid Waste Management Unit.

During our meeting it was expressed that dredge spoils may be used as fill and landscaping material for the park. Regardless of the results of the EP tox test, the concentration of hydrocarbons and metals may pose a health threat for this type of use. A more appropriate use would be land fill cover. It would be advantageous to survey the area to determine if any land fills are scheduled to close at the time dredge spoils will need to be removed. Arrangements could be made to use this material as final cover for the land fill.

These are just a few preliminary thoughts I generated through our field meeting and reviewing the data that was provided at that time. As mentionedpreviously the need for additional diagnostic evaluation of the project appears to be necessary. If there is any way DEP water Compliance can assist you with this evaluation feel free to give me a call at 566-2588.

Sincerely your,

Charles Lee

Charles Lee
Environmental Analyst

STATE OF CONNECTICUT

STATE BOARD OF EDUCATION

CONNECTICUT HISTORICAL COMMISSION

June 16, 1989

Mr. Joseph L. Ignazio
Chief, Planning Division
New England Division, Corps of
Engineers
424 Trapelo Road
Waltham, MA 02254

SUBJECT: Proposed Dredging
Hockanum River
Manchester, CT

Dear Mr. Ignazio:

The State Historic Preservation Office has reviewed the preliminary archaeological assessment prepared by the Corps of Engineers concerning the above-named project. This office concurs that the Union Manufacturing Company and its associated structures was of historic archaeological importance. However, recent highway improvements by the Connecticut Department of Transportation and the total modification of the nineteenth-century stone dam by the Town of Manchester have destroyed the scientific integrity and National Register potential for this industrial archaeological complex.

We concur with the Corps of Engineers recommendation that the original Hockanum flood plain may possess prehistoric archaeological sensitivity and that further field studies are warranted. In addition, this office concurs with the Corps professional assessment that the proposed disposal area possesses no archaeological potential.

We anticipate working with the Corps of Engineers towards examining the prehistoric archaeological sensitivity of the proposed project area vis-a-vis the National Historic Preservation Act of 1966.

The State Historic Preservation Office appreciates the opportunity to have reviewed and commented upon this project. For further information, please contact Dr. David A. Poirier, Staff Archaeologist.

Sincerely,

Dawn Maddox

Dawn Maddox
Deputy State Historic
Preservation Officer

DAP:nlw

TEL: (203) 566-3005
59 SOUTH PROSPECT ST. — HARTFORD, CONN. 06106

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02254-9149

REPLY TO
ATTENTION OF

June 7, 1989

Planning Division
Impact Analysis Branch

John W. Shannahan
Office of the State Historic Preservation
Officer for Connecticut
59 South Prospect Street
Hartford, Connecticut 06106

Subject: Hockanum River Reconnaissance Study

Dear Mr. Shannahan:

The Army Corps of Engineers is preparing a reconnaissance report for a proposed dredging project at Union Pond on the Hockanum River in Manchester, CT (Figure 1). The proposed project would involve dredging a portion of Union Pond to increase the depths for recreational boating. Current depths, in the area of the pond to be dredged, vary from 0 to 3 feet. We would appreciate your comments on this proposed plan.

Union Pond is a man-made body of water which covers an area of about 52 acres. The Pitkin Cotton Factory, the first cotton mill in Connecticut began operation at the south end of the pond in 1794. This mill eventually became the Union Manufacturing Company sometime in the early 19th century and this area became known as Union Village. The company remained in operation until 1890. In 1894 a French company began using part of the plant for a wool scouring business. This concern went out of business several years later and the area was abandoned.

Several dams have been built at this location during the past 200 years. In 1865-66 a stone dam, twenty feet thick at the base, was constructed by the Union Manufacturing Company. This was the third dam built at this location at the south end of the pond. The dam was raised in 1901 to the present spillway crest (See enclosed photographs). This dam was reconstructed in 1986-88 and little of the original stone dam remains exposed. The old dam is still present. However, the subsequent structures have been built over and around it so it is no longer visible even when the pond is drained. The structures associated with the dam and manufacturing company are no longer standing. However evidence may remain as historic archaeological sites.

The proposed project would involve dredging the upper third or northerly section of the pond and removing 60,000 to 120,000 cubic yards (cy) of material. This area appears to be mostly natural fill and part of the original floodplain which was flooded when the dam was raised in 1901. Water quality in the pond is poor to marginal. This is caused by industrial pollutants which come from upstream communities. For purposes of this study the disposal area currently under investigation is a portion of the sand and gravel pit located to the northeast of Union Pond (Figure 1).

We feel that the proposed project would have no effect on historic period sites. A review of historic maps of the area revealed that no known structures were located upstream of the dam in the vicinity of the pond. Industrial and residential structures were situated downstream and to the southwest of the pond. Therefore, we feel that the proposed project will have no effect on significant historic structures or historic archaeological sites.

The proposed project area may have prehistoric site potential. Since this area was originally part of the Hockanum floodplain, evidence of prehistoric activity could be present at this location. Additional research would need to be performed in this area and soil profiles should be done to look for intact submerged land surfaces. If the soil profiles still contain considerable integrity then an archaeological survey may be required during later study stages.

The proposed disposal area at the adjacent sand and gravel pit has no archaeological potential. The area has been severely modified by the gravel operations and any sites which may have been present have been destroyed or seriously compromised. We feel therefore that disposal of the dredged material at this area is unlikely to have an effect upon any structure or site of historic, architectural or archaeological significance as defined by the National Historic Preservation Act of 1966, as amended. We would appreciate your concurrence.

We would like your comments on this proposed project. If you have any questions feel free to contact Ms. Kate Atwood at (617)-647-8796.

Sincerely,

Joseph L. Ignazio
Chief, Planning Division

Enclosure

United States Department of the Interior

FISH AND WILDLIFE SERVICE
400 RALPH PILL MARKETPLACE
22 BRIDGE STREET
CONCORD, NEW HAMPSHIRE 03301-4901

Joseph L. Ignazio, Chief
Planning DIvision
U.S. Army Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02254

June 5, 1989

ATTN: Impact Analysis Branch

Dear Mr. Ignazio:

This responds to your letter dated May 2, 1989, for information on the presence of Federally listed and proposed endangered or threatened species in accordance with the proposed Section 107 Project at Union Pond in Manchester, Connecticut.

No Federally listed or proposed threatened and endangered species under our jurisdiction are known to occur in the project area, with the exception of occasional transient individuals. However, you may wish to contact Julie Victoria of the Connecticut Department of Environmental Protection, Sessions Woods WMA, P.O. Box 1238, Burlington, Connecticut 06103, at 203-584-9830, for information on state listed species. No Biological Assessment or further consultation is required with us under Section 7 of the Endangered Species Act. Should project plans change, or additional information on listed or proposed species becomes available, this determination may be reconsidered.

This response relates only to endangered species under our jurisdiction. It does not address other legislation or our responsibilities under the Fish and Wildlife Coordination Act.

A list of Federally designated endangered and threatened species in Connecticut is inclosed for your information. Thank you for your cooperation and please contact Susi von Oettingen of this office at 603-225-1411 if we can be of further assistance.

Sincerely yours,

Gordon E. Beckett

Inclosure

Gordon E. Beckett
Supervisor
New England Area

STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION
NATURAL RESOURCES CENTER
165 Capitol Avenue, Room 553
Hartford, Connecticut 06106
Connecticut Natural Diversity Data Base

May 11, 1989

Joseph Ignazio
Dept. of Army Corps of Engineer
424 Trapelo Road
Waltham, MA 02254

Dear Mr. Ignazio:

I have reviewed Natural Diversity Data Base maps and files regarding: Manchester, CT - Union Pond Dredge Project. According to our information, there are no known extant populations of Federally Endangered and Threatened species or Connecticut "Species of Special Concern" occurring at the site in question.

Natural Diversity Data Base information includes all information regarding critical biologic resources available to us at the time of the request. This information is a compilation of data collected over the years by the Natural Resources Center's Geological and Natural History Survey and cooperating units of DEP, private conservation groups and the scientific community. This information is not necessarily the result of comprehensive or site-specific field investigations. Consultation with the Data Base should not be substituted for on-site surveys required for environmental assessments. Current research projects and new contributors continue to identify additional populations of species and locations of habitats of concern, as well as, enhance existing data. Such new information is incorporated into the Data Base as it becomes available.

Thank you for providing us with the opportunity to comment on this proposed project. If we may be of further assistance, do not hesitate to call 566-3540.

Sincerely,

Nancy Murray
Biologist

NM/dmt

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02254-9149

REPLY TO
ATTENTION OF

May 8, 1989

Planning Division
Impact Analysis Branch

Ms. Leslie Carothers, Commissioner
Department of Environmental Protection
165 Capitol Avenue
Hartford, Connecticut 06106

Dear Ms. Carothers:

We are proposing to conduct a Section 107 Project at Union Pond in Manchester, Connecticut. The purpose of this letter is to request your comments on the proposed project. A location map of the project area is enclosed to aid you in your work.

The proposed project involves the dredging of the upper portion of Union Pond in order to create a recreational area suitable for water-based activities, such as boating, water-skiing, and swimming. The proposed project would remove approximately 60,000-100,000 cubic yards of sediment material. The method of dredging has not yet been determined, but will be investigated further into the study.

Coordination with state and local officials revealed the potential for chemical contamination in the upstream watershed. Various industries and two wastewater treatment plants are located upstream. The material to be dredged is currently being analyzed for physical properties (grain size) and the standard bulk chemicals (i.e. Cd; Cr; Cu; Hg; Pb; Zn; As; PCB; DDT; NO2/NO3; SO4; P; COD; and oil and grease). The sediment test results will be available for review the second week of May.

The proposed disposal site for the dredged material is the sand and gravel pit located adjacent to the project site (see attached map), if the material is found to be acceptable under the State of Connecticut's Solid Waste Management guidelines. Otherwise, an acceptable disposal site will be investigated.

Ms. Kerrin Dame, of the Impact Analysis Branch, and Mr. Mark Habel, the project manager, will be conducting a coordinated on-site meeting with interested State and Federal natural resource agencies on Tuesday, May 16, 1989 at 10:00 AM. The purpose of this meeting is to explain the proposed project and to elicit agency concerns and suggestions. Your agency's attendance at this meeting would be appreciated.

If you require further information about the proposed project or the project area please contact Ms. Kerrin Dame at (617) 647-8536.

Sincerely,

Joseph L. Ignazio
Chief, Planning Division

Attachment

Copy Furnished:

Mr. Denis Cunningham
Water Resources Unit
Dept. of Environmental Protection
165 Capitol Avenue
Hartford, Connecticut 06106

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02254-9149

REPLY TO
ATTENTION OF

May 8, 1989

Planning Division
Impact Analysis Branch

Mr. Douglas A. Thompson
Chief, Wetlands Protection Section
U.S. Environmental Protection Agency
Region 1
J.F.K. Building
Government Center
Boston, Massachusetts 02203

Dear Mr. Thompson:

We are proposing to conduct a Section 107 Project at Union Pond in Manchester, Connecticut. The purpose of this letter is to request your comments on the proposed project. Enclosed is a location map of the project area.

The proposed project involves the dredging of the upper portion of Union Pond in order to create a recreational area suitable for water-based activities, such as boating, water-skiing, and swimming. The proposed project would remove approximately 60,000-100,000 cubic yards of sediment material. The method of dredging has not yet been determined, but will be investigated further into the study.

Coordination with state and local officials revealed the potential for chemical contamination in the upstream watershed. Various industries and two wastewater treatment plants are located upstream. The material to be dredged is currently being analyzed for physical properties (grain size) and the standard bulk chemicals (i.e. Cd; Cr; Cu; Hg; Pb; Zn; As; PCB; DDT; NO2/NO3; SO4; P; COD; and oil and grease). The sediment test results will be available for review the second week of May.

The proposed disposal site for the dredged material is the sand and gravel pit located adjacent to the project site (see attached map) if the material is found to be acceptable under the State of Connecticut's Solid Waste Management guidelines. Otherwise, an acceptable disposal site will be investigated.

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If you require further information about the proposed project or the project area please contact Ms. Kerrin Dame at (617) 647-8536.

Sincerely,

Joseph L. Ignazio
Chief, Planning Division

Attachment

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02254-9149

REPLY TO
ATTENTION OF

May 2, 1989

Planning Division
Impact Analysis Branch

Ms. Nancy Murray
Connecticut Department of Environmental Protection
Natural Resources Center
165 Capitol Avenue, Room 553
Hartford, Connecticut 06106

Dear Ms. Murray:

We are proposing to conduct a Section 107 Project at Union Pond in Manchester, Connecticut. The purpose of this letter is to request a State list of endangered or threatened species for the project area, pursuant to the Fish and Wildlife Coordination Act of 1958, as amended. Enclosed is a location map of the area to aid you in your work.

The proposed project involves the dredging of the upper portion of Union Pond in order to create a recreational area suitable for water-based activities, such as boating, water-skiing, and swimming. The proposed project would remove approximately 60,000-100,000 cubic yards of sediment material. The method of dredging has not yet been determined, but will be investigated further into the study.

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If you require further information about the proposed project or the project area please contact Ms. Kerrin Dame at (617) 647-8536.

Sincerely,

Joseph L. Ignazio
Chief, Planning Division

Attachment

Same letter sent to:

Mr. Gordon E. Beckett, Supervisor
U.S. Fish and Wildlife Service
Ecological Services
Ralph Pill Building
22 Bridge Street
Concord, New Hampshire 03301

BARBARA B. KENNELLY
1ST DISTRICT, CONNECTICUT

WAYS AND MEANS

SUBCOMMITTEES:
SELECT REVENUE MEASURES
PUBLIC ASSISTANCE AND
UNEMPLOYMENT COMPENSATION

PERMANENT SELECT COMMITTEE
ON INTELLIGENCE

1230 LONGWORTH BUILDING
WASHINGTON, DC 20515
(202) 225-2265

ONE CORPORATE CENTER
HARTFORD, CT 06103
(203) 240-3120
FTS (203) 244-3120

Congress of the United States
House of Representatives
Washington, DC 20515

19 January 1989

Daniel M. Wilson
Colonel
Department of the Army
New England Division/Corps of Engineers
424 Trapelo Rd.
Waltham, MA 02254-9149

Dear Colonel Wilson:

I am writing to thank you for initiating the preliminary stage of the reconnaissance study of the Hockanum River/Union Pond site in Manchester, CT.

Yesterday, Mark Habel, Project Manager, and three staff from your division met with town officials and a member of my staff to discuss the start of the study. According to my district director, Robert Croce, the meeting was a positive one that outlined the parameters and criteria for the study, and data that the Army Corps would like to obtain from the town.

I am pleased that this effort is underway and want to offer my personal support to you and your staff to see that momentum continue toward a full feasibility study of the project. I have directed Mr. Croce to monitor all developments in Manchester relative to this project, and I intend to continue my efforts in Washington as well on behalf of the project.

Again thank you for your efforts in advancing the study. I look forward to working with you and your staff.

Sincerely,

Barbara B. Kennelly
Member of Congress

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02254-9149

REPLY TO
ATTENTION OF

September 30, 1988

Planning Division
Executive Office

Honorable Barbara Kennelly
House of Representatives
Washington, DC 20515-0701

Dear Ms. Kennelly:

On August 30, 1988 I took over command of the New England Division from the former Division Engineer Colonel Thomas A. Rhen. As part of my orientation to my new assignment, it was called to my attention that you wrote us on August 12, 1988 concerning a request for the Corps to undertake a reconnaissance study of the Hockanum River, Union Pond, in Manchester, Connecticut.

This letter is to advise you that I will undertake an investigation under the ongoing Continuing Authority of Section 107. I expect that when we conclude this reconnaissance investiation we will be in a better position to determine whether there is Federal interest in the problem.

My staff will make necessary contacts with Mr. Mark Pellegrini the Director of Planning for the Town of Manchester as well as members of your staff who participated in an earlier site visit.

If I can be of further assistance, I can be reached at (617) 647-8220.

Sincerely,

Daniel M. Wilson
Colonel, Corps of Engineers
Division Engineer

Copy Furnished:

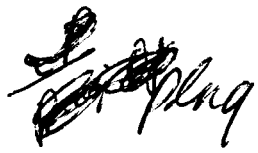
Honorable Barbara Kennelly
Representative in Congress
618 Federal Building
450 Main Street
Hartford, Connecticut 06103

BARBARA B. KENNELLY
1ST DISTRICT, CONNECTICUT

WAYS AND MEANS

SUBCOMMITTEES:
SELECT REVENUE MEASURES
PUBLIC ASSISTANCE AND
UNEMPLOYMENT COMPENSATION

PERMANENT SELECT COMMITTEE
ON INTELLIGENCE



1230 LONGWORTH BUILDING
WASHINGTON, DC 20515
(202) 225-2265

ONE CORPORATE CENTER
HARTFORD, CT 06103
(203) 240-3120
FTS (203) 244-3120

Congress of the United States
House of Representatives
Washington, DC 20515

Thomas A. Rhen
Colonel
Department of the Army
New England Division, Corps of Engineers
424 Trapelo Road
Waltham, MA 02254-9149

August 12, 1988

Reply to Hartford

Dear Colonel Rhen:

I am in receipt of your letter of July 8, 1988 and welcome this opportunity to clear up any confusion. The Corps was requested to undertake a reconnaissance study of the Hockanum River/Union Pond in Manchester, Connecticut through my letter of May 13, 1988 and a May 24, 1988 letter from Mark Pellegrini, Director of Planning, Town of Manchester.

The request was made pursuant to existing project authorization contained in Section 107 of the Omnibus Water Bill of 1986 which provides the Corps with ongoing authority to build small projects estimated to cost less than $4 million without specific Congressional authorization. As you are well aware, Section 107 reconnaissance studies are conducted at full federal expense and do not require earmarked Congressional appropriations.

While I am ever cognizant of the Administration's policy with regard to projects that entail recreation, you will note from my original letter that this project entails both navigation and recreation. Further, since the very purpose of the reconnaissance study is to determine the feasibility of the project and the federal interest, I trust that the Corps would not attempt to anticipate the results of such a study.

In addition, I am pleased to say that Public Law 100-371, the Energy and Water Appropriation for Fiscal 1989, contains $50,000 earmarked for initiation of the reconnaissance study. I have enclosed of copy of the language for your information. I stand ready to provide any assistance necessary for commencement of the study, as does the Town of Manchester.

Sincerely,

Barbara

BARBARA B. KENNELLY
Member of Congress

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02254-9149

July 8, 1988

REPLY TO
ATTENTION OF

Planning Division
Coastal Development Branch

Honorable Barbara Kennelly
House of Representatives
Washington, D.C. 20515-0701

Dear Ms. Kennelly:

I wrote to you on June 1, 1988 in response to your letter of May 13, 1988, regarding Union Pond in Manchester, Connecticut. That was also the date that Mr. John T. Smith, of my staff, met with your Mr. Bob Croce and Ms. Anne Urban, as well as Robert B. Weiss, Manchester, Town Manager, and several other representatives at the Union Pond area.

Mr. Smith outlined the two primary areas of responsibility of the Corps, namely navigation and flood control. He also noted that recent policy changes prevent Corps involvement in navigational projects that are primarily recreational in nature. Inasmuch as the navigational benefits generated by improvements on Union Pond would be recreational in nature, the improvements would not be eligible for Corps funding.

With regard to flood control, Mr. Smith noted that the town has estimated the removal of 100,000 cubic yards of earth within Union Pond, a figure that seems reasonable. This would provide an amount of storage (62 acre-feet) less than 0.1 inch of run-off from the Hockanum's drainage area at Union Pond providing it was kept at a low level. If the pool were maintained full, the 62 acre-feet would have little, if any flood reduction value. Mr. Croce provided an excerpt from House Report 100-618, which if approved, would provide". . . $50,000 to initiate a study for one time dredging and a permanent solution to sedimentation problems on the Hockanum River in Connecticut". If that money were made available it is unlikely that the Corps could recommend a plan that would involve dredging the mud flats in Union Pond however, the findings might be of value to the community.

If I can be of further assistance, please don't hesitate to contact me at (617) 647-8220, of Mr. John Smith, of my staff, at (617) 647-8528.

Sincerely,

Thomas A. Rhen
Colonel, Corps of Engineers
Division Engineer

Copy Furnished:
Honorable Barbara Kennelly
Representative in Congress
618 Federal Blg., 450 Main Street
Hartford, Connecticut 06103

BARBARA B. KENNELLY
1ST DISTRICT, CONNECTICUT

WAYS AND MEANS

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ONE CORPORATE CENTER
HARTFORD, CT 06103
(203) 240-3120
FTS (203) 244-3120

Congress of the United States
House of Representatives
Washington, DC 20515

June 3, 1988

Thomas A. Rhen
Colonel
Department of the Army
New England Division, Corps of Engineers
424 Trapelo Road
Waltham, MA 02254-9149

Dear Colonel Rhen:

Thank you so much for your prompt attention toward the initiation of a reconnaissance study for the Hockanum River in Manchester, Connecticut.

On Wednesday, June 1, 1988 John Smith of your office met with Manchester town officials and members of my staff to discuss the details of the project, and to visit the site. I am pleased with the prompt attention the corps has afforded this project, and I look forward to working with you in the weeks ahead as the reconnaissance study begins.

As stated earlier, it is my understanding that the initial study can be conducted under your ongoing Section 107, Small Projects Authority. Robert Croce, District Director of my Hartford Office informed me that he made mention of this authority to Mr. Smith as well as sharing a copy of the bill's language as contained in the legislation passed by the House.

Again thank you for your continued cooperation in this matter. I look forward to hearing from you soon.

Sincerely,

BARBARA B. KENNELLY
Member of Congress

Town of Manchester

41 Center Street

Manchester, Connecticut 06040

ROBERT B. WEISS, GENERAL MANAGER

PETER P. DiROSA, JR., MAYOR
STEPHEN T. CASSANO, DEPUTY MAYOR
JAMES F. FOGARTY, SECRETARY

DIRECTORS
MARY ANN HANDLEY
GEOFFREY NABB, ESQ.
RONALD OSELLA
KENNETH N. TEDFORD, ESQ.
BARBARA B. WEINBERG
THEUNIS WERKHOVEN

May 24, 1988

Mr. Joseph Ignazio, Chief
Planning Division
Army Corps of Engineers
424 Prepelo Road
Waltham, Massachusetts 02154

Dear Mr. Ignazio:

The town was delighted to learn that the Army Corps of Engineers has been requested to initiate a reconnaissance study for the Hockanum River/Union Pond in Manchester. Please contact me at 203-647-3044 at your earliest convenience to arrange a meeting with town staff and a representative of Congresswoman Barbara Kennelly to initiate the study.

We look forward to working with you on this important project.

Very truly yours,

Mark Pellegrini
Director of Planning

MP:ka
cc: Colonel Thomas Rhen
Anne Urban
Robert B. Weiss

BARBARA B. KENNELLY
1ST DISTRICT, CONNECTICUT

WAYS AND MEANS

SUBCOMMITTEES:
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(202) 225-2265

ONE CORPORATE CENTER
HARTFORD, CT 06103
(203) 240-3120
FTS (203) 244-3120

Congress of the United States
House of Representatives
Washington, DC 20515

May 13, 1988

Colonel Thomas Rhen
Division Engineer
Army Corps of Engineers
424 Prepelo Road
Waltham, Massachusetts 02154

Dear Colonel Rhen:

Per a discussion with Mr. Joseph Ignazio, Chief of the Planning Division, I would like to request that the Corps of Engineers initiate a reconnaissance study for the Hockanum River in Manchester, Connecticut.

The Town of Manchester, is proposing clean-up and enhancement of the entrance of the Hockanum River into Union Pond to facilitate navigation and recreation. The project is a response to significant residential development adjacent to the site. The town is proposing one-time dredging and a permanent solution to sedimentation. The dredge material may be toxic/hazardous. Preliminary estimates indicate the necessity of removal of approximately 100,000 cubic yards fo dredge material.

The Hockanum River is a tributary of the Connecticut River. Preliminary project cost estimates range from $400,000 to $1,000,000. It is my understanding that a reconnaissance study, can be conducted under your ongoing Section 107, Small Projects Authority.

I would like to arrange a meeting at your convenience with a member of my staff and local officials to discuss details. In the interim, any questions you may have should be directed to Pat Kery in my Washington Office at (202)225-2265.

Thank you.

Sincerely,

Barbara B. Kennelly

BARBARA B. KENNELLY
Member of Congress

BBK:pk

HOCKANUM RIVER
AT UNION POND
MANCHESTER, CONNECTICUT

NAVIGATION IMPROVEMENT STUDY
RECONNAISSANCE REPORT

APPENDIX B
ENGINEERING, DESIGN
AND COST ESTIMATES

OCTOBER 1989

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

ENGINEERING INVESTIGATIONS

HYDROGRAPHIC SURVEYS

A hydrographic condition survey of Union Pond was conducted in June 1989. The results of this survey are shown in Figure B-1. The survey covered the entire pond from the spillway crest upstream to the Hockanum River's inlet to the pond. Depths on the survey are referenced to NGVD, with the spillway crest elevation for the Union Pond Dam at approximately 142.3 feet NGVD. Depths in the pond ranged from about 18 feet below the spillway elevation (BSE) in the vicinity of the spillway to -2 feet BSE in the upper reaches.

The hydrographic survey was used to develope a contour map of the pond bottom's topography. This information was used to determine dredging limits for the varrious alternative dredge depths being considered. The contour map is shown as Figure B-2.

SUBSURFACE INVESTIGATIONS

No subsurface investigations were undertaken during the course of this study. Machine probings and borings would need to be conducted as part of any further preconstruction investigations in the areas proposed for dredging. Penetration would need to be to a depth at least as great as the depth of dredging being contemplated.

NATURE OF MATERIAL TO BE REMOVED

The Union Pond Dam was raised to its present height in 1901, submerging the former floodplain which occupied what is now the upper one third of the pond's length. This area now has a depth of about -2 feet BSE. The submerged floodplain is crossed by the former river channel which is still lined with the stumps of large trees which were cut when the pond was raised. The former river channel and upper end of the pre 1901 pond area have depths of about -5 feet BSE. At the lower end of the former floodplain a transitional slope of silty sediments, assumed to be predominantly from post 1901 deposition, slopes down to the lower pond bottom.

US Department of Agricultutre, Soil Conservation Service maps were consulted to determine soil types in the pond area. The area bordering the upper pond, the area proposed for dredging, is listed as terrace escarpments composed of sand and gravel. These deposites have been extensively quarried in the parcel now owned by the town and proposed for park development. The southern two-thirds of the pond is bordered by deposits of Manchester Gravelly Sandy Loam, with two exceptions. A small area of Hartford Sandy Loam is located north of the the north abutment of the dam, and a small area of Rumney Sandy Loam is located beneath and downstream of the dike.

The Union Pond Dam is founded upon a bedrock ledge which forms the southwestern boundary of the pond. No other ledge exposures were noted in the upstream areas nor on the pond bottom when it was viewed in a drained condition in late 1988. The ledge upon which the dam itself is founded, however, has been obscured upstream of the dam by a covering of clay placed to prevent seepage. No dredging is planned in the pond's lower reach.

Sediment samples were taken in the area to be dredged in the upper third of the pond in April 1989. Tube samples were taken at all three sample sites to a depth of about 2 feet. One sample was taken from the center of the the submerged pre-1901 floodplain. The other two samples were taken from the slope between the former floodplain and transition to the deeper lower pond bottom, one on either side of the remnant pre-1901 river inlet. The sample locations are shown on the pond bottom contour map in Figure B-2. The results of the tests performed on these samples are contained in Appendix D - Water and Sediment Quality Report. Physical tests showed the material to be predominantly sandy organic silt. The sample from the middle of the old floodplain was of a coarser nature, at 46 to 58 percent fines, than the material from the slope, at 68 to 80 percent fines. The sample site from the east side of the old river inlet was of a finer nature than the other sites and exhibited some plasticity. Wood fibers and weeds were found at all levels of the samples from the slope and the upper fraction of the sample from the old floodplain.

Chemical testing of the material showed it to be contaminated, though not severely so, with heavy metals, and Petroleum Hydrocarbons. Metals found in moderate to high concentrations included Arsenic, Cadmium, Chromium, Copper, Lead, Mercury and Zinc. While elevations were not high enough to rule out all forms of upland disposal, additional testing would be required to make a final determination of acceptability for disposal. Such tests would include an EP Toxicity test and other tests designed to measure the material's potential to release contaminants into ground water.

QUANTITY ESTIMATES

Quantity estimates were developed in order to determine the quantity of material to be removed for the various alternative dredge depths under consideration. The incremental dredge depths being analyzed are 5, 6, 7 and 8 feet below the spillway crest elevation. The areas to be dredged are the upper third of the pond and a large submerged shallow area at mid-pond along the western shore. The areas to be dredged are shown in Figure B-3.

The quantity estiamtes for forming the General Navigation Features of the project are shown in Table B-1. The estimates are based on construction of the project using land based equipment which would excavate the material with the pond in a drained condition. Since elevations can be more accurately determined with this type of construction than with a waterborne dredging method, no overdepth increment is included in the quantity estimates.

TABLE B-1
QUANTITIES OF MATERIAL TO BE REMOVED
FOR GENERAL NAVIGATION FEATURES

PROJECT DEPTH	QUANTITY (CUBIC YARDS)
-5 Feet BSE	15,700
-6 Feet BSE	26,900
-7 Feet BSE	43,800
-8 Feet BSE	71,200

DISPOSAL OF DREDGED MATERIAL

The town owned parcel at the northwest corner of the pond, a former sand and gravel pit, was originally proposed as the disposal site for the dredged material. The material was to have been capped with cleaner material and the site developed as a public park with water access. This alternate for disposal would represent the least costly method due to its proximity to the project site and the lack of rehandling necessary. Due to the material's degree of contamination, it is unlikely that this preferred disposal site could be used. The coarse nature of the soils at the site could allow contaminants in the sedimaents to reenter the pond through leaching. Additional groundwater studies may show this site to be acceptable provided some form of containment such as clay and/or plastic liners together with adequate capping are used. However, such methods would be costly.

There are a number of existing landfill operations in the immediate area which could stockpile the material for use as daily cover or as a final cap, should a facility be scheduled for closure near the time this project is constructed. The three facilities closest to the project site are located in Manchester and the neighboring towns of East Windsor and East Hartford. As stated earlier, additional testing would be required to determine the dredged material's suitability for such disposal options. In any event, the cost of disposal for the dredged material will represent a significant part of the project's first cost.

The three identified landfills are all within a 7 mile haul of the project site. The closest is located next to Laurel Lake through which the Hockanum River flows, downstream of Union Pond, about 4.6 miles from the project site. The facility is located behind the town of Manchester's wastewater treatment plant. The seacond is located adjacent to the north bank of the Hockanum River in East Hartford, further downstream, about 6.5 miles from the project site. The third is located in East Windsor, about 7 miles north of the project site at an old gravel pit. Of the three sites, the two located downstream along the Hockanum are not likely candidates. They lie adjacent to wetlands bordering the river and may present the same problems with the potential for reintroduction of contaminents to the river as the originally considered waterfront park site. For the purposes of this analysis therefore, the East Windsor site will be used to develop cost estimates.

COST ESTIMATES

The cost estimates for dredging and disposal are based on estimated construction durations of between 3 and 7 weeks. Costs include mobilization and demobilization costs, contractor profit and overhead. No navigation aids would be required. Costs were computed at July 1989 price levels. The costs of the General Navigation Features of the project (GNF) for the four incremental depths are shown in Table B-2.

TABLE B-2
HOCKANUM RIVER AT UNION POND
COST ESTIMATES FOR GNF

Dredge Depth (BSE)	-5 Feet	-6 Feet	-7 Feet	-8 Feet
EXCAVATION COST				
Excavation & Disposal				
- Cubic Yards	15,700	26,900	43,800	71,200
- Cost/cy	$10.30	$9.50	$8.90	$8.75
Excavation Cost	$162,000	$256,000	$390,000	$623,000
Contingencies	41,000	64,000	98,000	156,000
Subtotal	$203,000	$320,000	$699,000	$779,000
Engineering & Design	19,000	20,000	22,000	24,000
Supervision & Administration	28,000	35,000	45,000	63,000
TOTAL GNF COST	$250,000	$375,000	$766,000	$866,000
CONSTRUCTION PERIOD (MONTHS)	1	1	2	2
(Interest During Construction)	(nil)	(nil)	($ 3,000)	($ 3,000)

TABLE B-3
HOCKANUM RIVER, CONNECTICUT
COST OF RELATED NON-FEDERAL IMPROVEMENTS

Paved Parking Area	$44,000
Paved Boat Ramp	36,000
Potable Water Service	1,000
TOTAL	$81,000

RELATED LOCAL IMPROVEMENTS

In order to generate full project benefits and satisfy the items of local cooperation, the project sponsor, the town of Manchester, must undertake improvements to accomodate the projected navigational usage of the project. These improvements would consist of providing shoreside facilities and services to accomodate the envisioned future demand.

The small public park at the southeast corner of the pond is the site of a dirt parking area and an unimproved dirt boat ramp. No access facilities exist at the town owned northwest parcel. It would be necessary to contsruct a paved boat ramp and parking area to allow adequate access for the volume of usage envisioned, which is about 70 launches per day in the peak usage season. The parking area would have to be large enough to accomodate vehicles and their trailers. The use of motorcraft on the pond is not envisioned, except perhaps for small outboards. The provision of a fuel facility is therefor not necessary. Provision for potable water service is required and electrical service to allow night activities may be desirable. Lighting already exists at the southeast park around the unused outdoor skating rink.

The town and other shorefront property owners may wish to construct boat docks and place floats along the shoreline to improve boating access. Such facilities, especially those open to the public, would augment, but not be required in order to generate, the level of usage projected for this project. A small island, the product of disposal activities from a previous municipal dredging project in the lower pond, is located close offshore of the skating rink area. If connected to the mainland by a wooden bridge, the island would provide a sufficient platform from which to construct a float system for a public recreational small boat facility.

Given the ammount of public land along the pond's shoreline, the potential exists to constuct a range of facilities designed to increase public access to the pond and for other recreational uses. However, those facilities and services necessary to satisfy the requirements for Federal participation in a naviagtional improvement are limited to provide an adequate paved parking area and boat ramp and potable water service.

The Economic Analysis estimates usage at about 70 launches per day with an average of 1.5 users per boat. These would be small craft, canoes, rowboats, sailboards and small outboards and sailboats. It is estimated that only about one-third of the vehicles carrying these craft would be hauling trailers, thus reducing the area need for parking. The cost of grading and paving an area sufficient to accomadate this number of vehicles is estimated to cost about $43,900.

Provision of a paved boat ramp would require only minor excavation and placement of gravel and asphalt or concrete paving due to the pond shore's steep slope. The cost for providing such a facility would be about $36,000. The cost of providing potable water service is estimated at about $900. The total cost of required non-Federal facility and service improvements, as shown in Table B-3, is therefor $80,800, say $81,000. This cost would be the same regardless of which dredging depth alternative is selected.

MAINTAENANCE COSTS

Maintenance of the General Navigation Features and the non-Federal improvements would be necessary over the 50 year life of the project to ensure the continuing realization of project benefits. Periodic dredging would be necessary to maintain project depth, particularly in the upper pond where sediment laden waters of the Hockanum River would continue to deposit sandy silts and other materials derrived from upland erosion. Maintenance of the non-Federal parking areas, boat ramp and water service equipment would also be necessary.

For the purposes of this report it is assumed that maintenance dredging would be required twice during the project life. An average annual shoaling rate of four percent of the material removed for the improvement being deposited per year was also assumed. Removal and disposal of maintenance material would be via the same methods and disposal site locations being considered for the improvement project. Maintenance costs include contingencies, E & D anfd S & A costs. Maintenance of the non-Federal facilities improvements is estimated to be about one percent of the original construction cost per year. Table B-4 shows the annualized maintenance costs for the project.

TABLE B-4
HOCKANUM RIVER, CONNECTICUT
ANNUAL MAINTENANCE COSTS

	-5' BSE	-6' BSE	-7' BSE	-8' BSE
GENERAL NAV. FEATURES				
Annual 4% Shoal Volume	630	1,080	1,750	2,850
Cost per Cubic Yard	$10.30	$ 9.50	$ 8.90	$ 8.75
Maintenance Dredging Cost	$ 6,500	$ 9,500	$15,600	$24,900
NON-FEDERAL IMPROVEMENTS				
1 % of First Cost	$ 800	$ 800	$ 800	$ 800
TOTAL MAINTENANCE COST	$ 7,300	$10,300	$16,400	$25,700

ANNUAL CHARGES

Annual charges assessed to each incremental alternative dredging depth are a combination of the various annual maintenance costs and the interest and amortization charge resulting from ther first cost of improvement assessed over the 50-year project life. The charge for interest and amortization is based on a rate of 8-7/8 percent. The annual charges for each incremental depth are shown in Table B-5.

TABLE B-5
HOCKANUM RIVER, CONNECTICUT
ANNUAL CHARGES

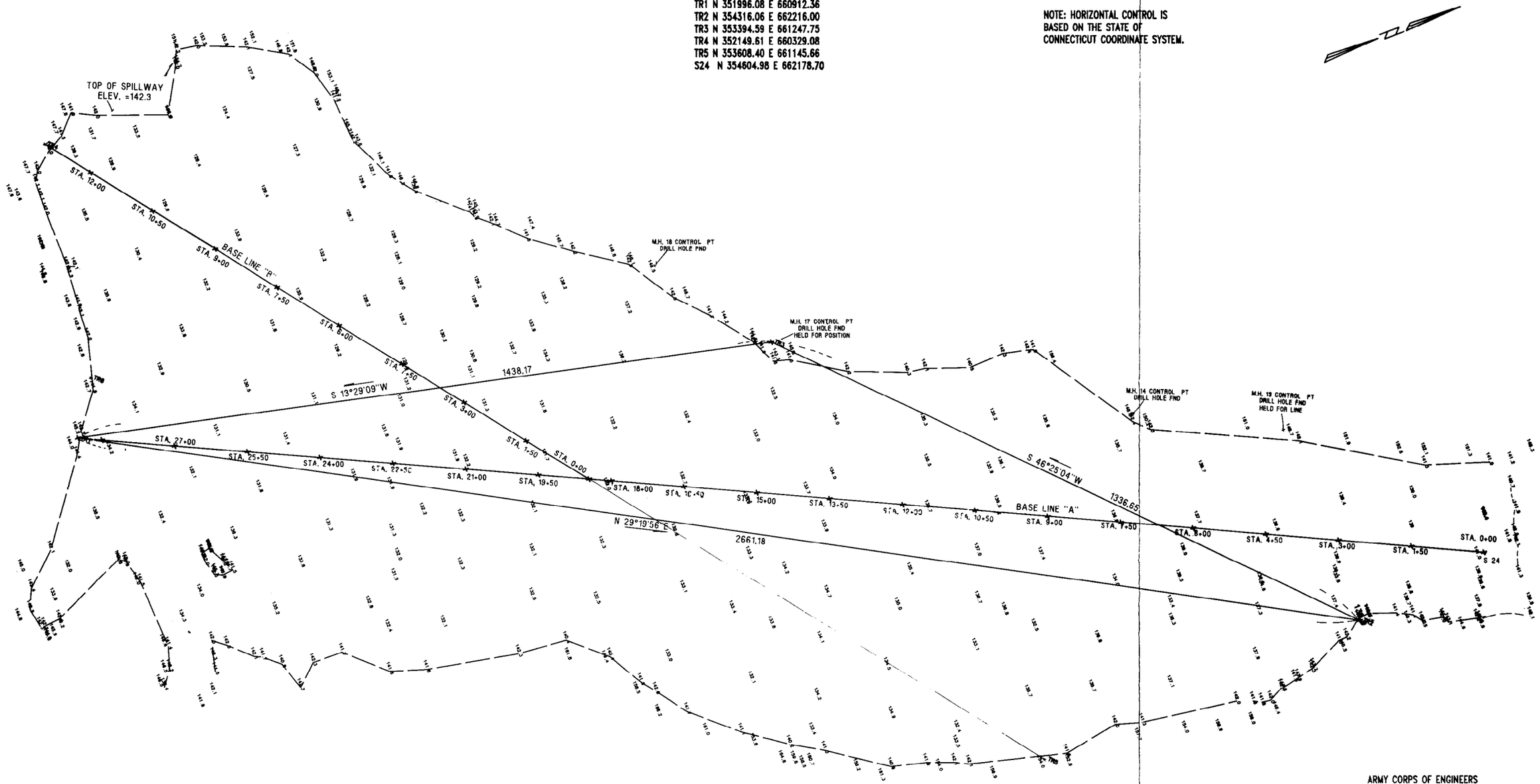
	-5' BSE	-6' BSE	-7' BSE	-8' BSE
GENERAL NAVIGATION FACILITIES				
First Cost	$250,000	$375,000	$766,000	$866,000
Interest During Const.	Nil	Nil	3,000	3,000
Total	$250,000	$375,000	$769,000	$869,000
Interest & Amortization	$22,500	$33,800	$69,200	$78,200
Maintenance Dredging	6,500	9,500	15,600	24,900
Subtotal	$29,000	$43,300	$84,800	$103,100
NON-FEDERAL IMPROVEMENTS				
Interest & Amortization	7,300	7,300	7,300	7,300
Maintenance	800	800	800	800
Subtotal	$ 8,100	$ 8,100	$ 8,100	$ 8,100
TOTAL ANNUAL CHARGES	$37,100	$51,400	$92,900	$111,200

CONTROL POINTS

MH13 N 354310.69 E 661796.40
MH14 N 354034.15 E 661653.87
MH17 N 353396.58 E 661247.80
MH18 N 353227.09 E 661015.73
TR1 N 351996.08 E 660912.36
TR2 N 354316.06 E 662216.00
TR3 N 353394.59 E 661247.75
TR4 N 352149.61 E 660329.08
TR5 N 353608.40 E 661145.66
S24 N 354604.98 E 662178.70

NOTE: ELEVATION REF.
APPROX. N.G.V.D. OF 1929
TOP OF SPILLWAY ELEV.=142.3

NOTE: HORIZONTAL CONTROL IS BASED ON THE STATE OF CONNECTICUT COORDINATE SYSTEM.

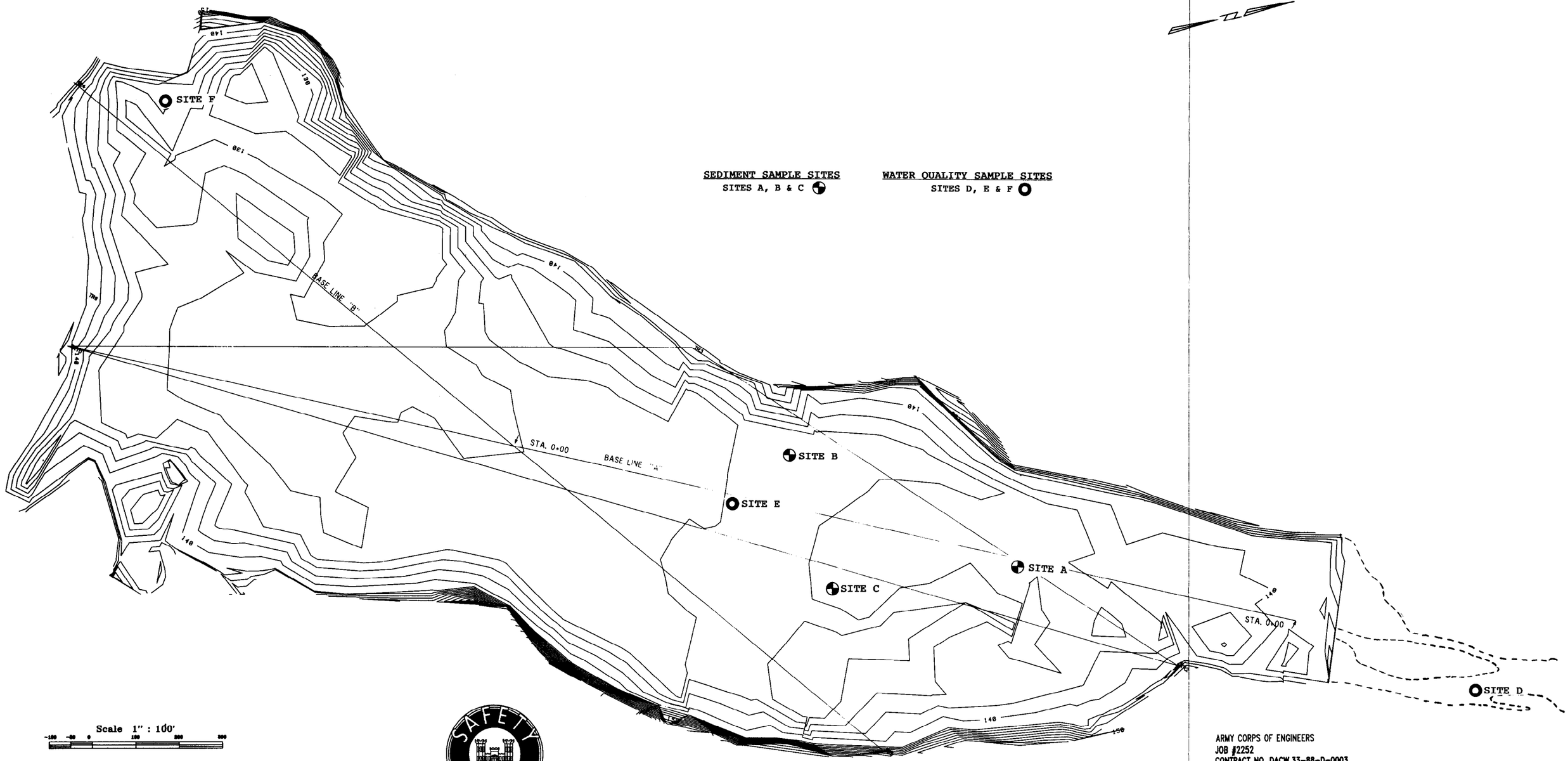


Scale 1" : 100'

SAFETY PAYS

ARMY CORPS OF ENGINEERS
JOB #2252
CONTRACT NO. DACW.33-88-D-0003
Dunn Engineering CO.; INC.
Delivery Order No. 12
PROJECT: CROSS SECTIONS OF
UNION POND
MANCHESTER CONNECTICUT
DATE: JUNE 29,1989
WORKING PLAN
SHEET #1 OF 9

FIGURE B-1



SEDIMENT SAMPLE SITES
SITES A, B & C

WATER QUALITY SAMPLE SITES
SITES D, E & F

SAFETY PAYS

NOTE: ELEVATION REF.
APPROX. N.G.V.D. OF 1929
TOP OF SPILLWAY ELEV.=142.3

ARMY CORPS OF ENGINEERS
JOB #2252
CONTRACT NO. DACW.33-88-D-0003
Dunn Engineering CO.; INC.
Delivery Order No. 12
PROJECT: CROSS SECTION OF
UNION POND
MANCHESTER CONNECTICUT
DATE: JUNE 29,1989
TOPOGRAPHIC
SHEET # 2OF 9

FIGURE B-2

CONTROL POINTS

MH13 N 354310.69 E 661796.40
MH14 N 354034.15 E 661653.87
MH17 N 353396.58 E 661247.80
MH18 N 353227.09 E 661015.73
TR1 N 351996.08 E 660912.36
TR2 N 354316.06 E 662216.00
TR3 N 353394.59 E 661247.75
TR4 N 352149.61 E 660329.08
TR5 N 353608.40 E 661145.66
S24 N 354604.98 E 662178.70

NOTE: ELEVATION REF.
APPROX. N.G.V.D. OF 1929
TOP OF SPILLWAY ELEV.=142.3

NOTE: HORIZONTAL CONTROL IS BASED ON THE STATE OF CONNECTICUT COORDINATE SYSTEM.

NAVIGATION PROJECT LIMITS

AREA EXCAVATED TO:

5 FEET BSE

6 FEET BSE

7 FEET BSE

8 FEET BSE

UNION POND DAM

TOP OF SPILLWAY ELEV. =142.3

M.H. 18 CONTROL PT DRILL HOLE FND

M.H. 17 CONTROL PT DRILL HOLE FND HELD FOR POSITION

PROPOSED NORTHWEST PARK SITE

M.H. 14 CONTROL PT DRILL HOLE FND

M.H. 13 CONTROL PT DRILL HOLE FND HELD FOR LINE

S 13°29'09" W 1438.17

N 29°19'56" E 2661.18

HOCKANUM RIVER INLET

DIRT BOAT RAMP

EXISTING SOUTHEAST PARK

CEMETERY

Scale 1" : 100'

-100 -50 0 100 200 300

NOTE: Shoreline and old Hockanum River channel and other upper pond bottom features taken from town of Manchester Sectional Map, dated March 1958.

SAFETY PAYS

ARMY CORPS OF ENGINEERS
JOB #2252
CONTRACT NO. DACW.33-88-D-0003
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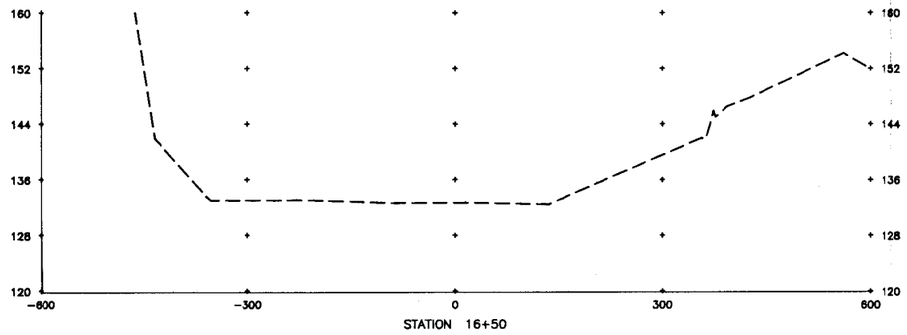
UNION POND
MANCHESTER CONNECTICUT
DATE: JUNE 29,1989
WORKING PLAN
SHEET #1 OF 9

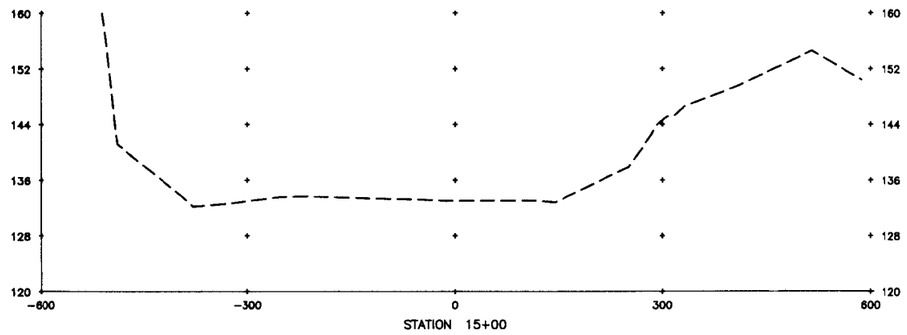
ALTERNATIVE EXCAVATION DEPTHS

FIGURE B-3

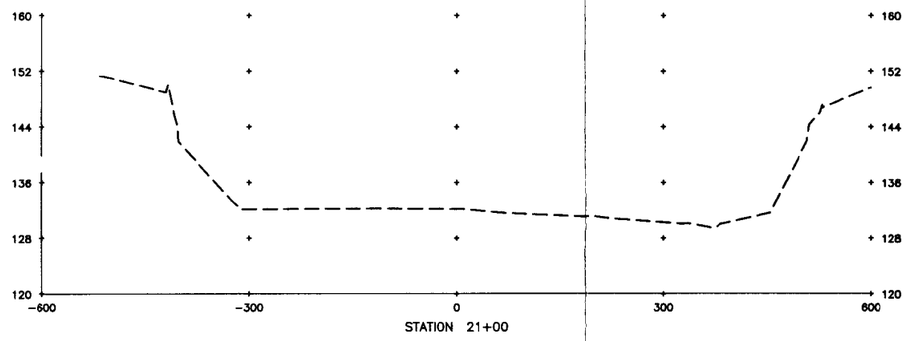
BASELINE "A"



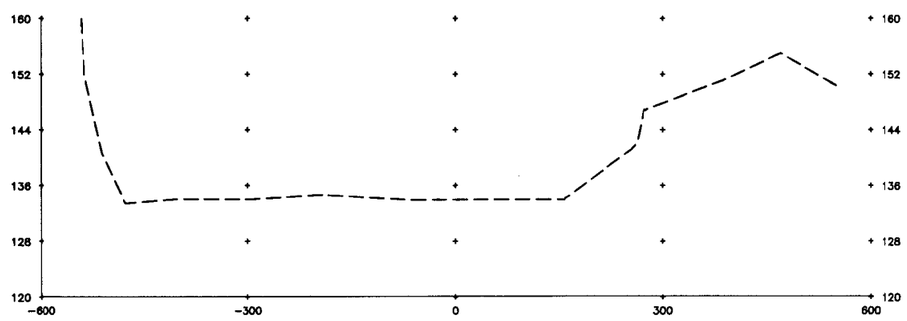
STATION 16+50



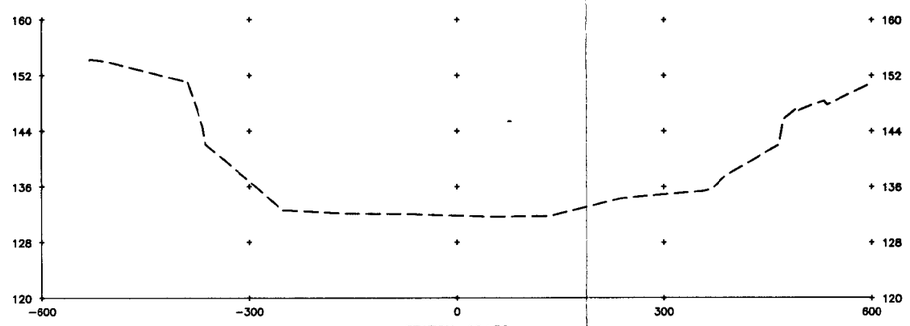
STATION 15+00



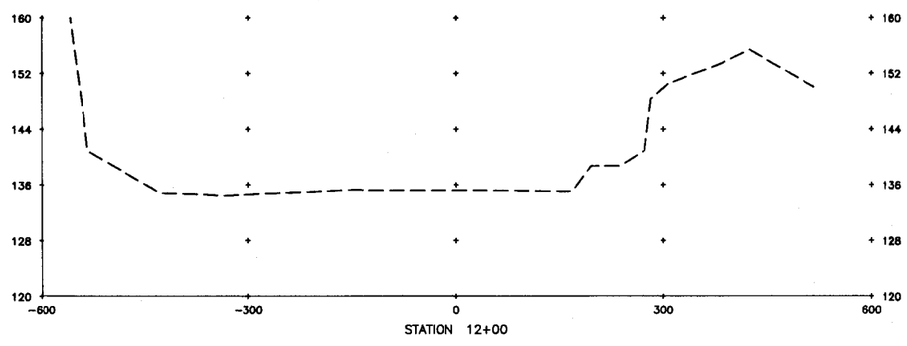
STATION 21+00



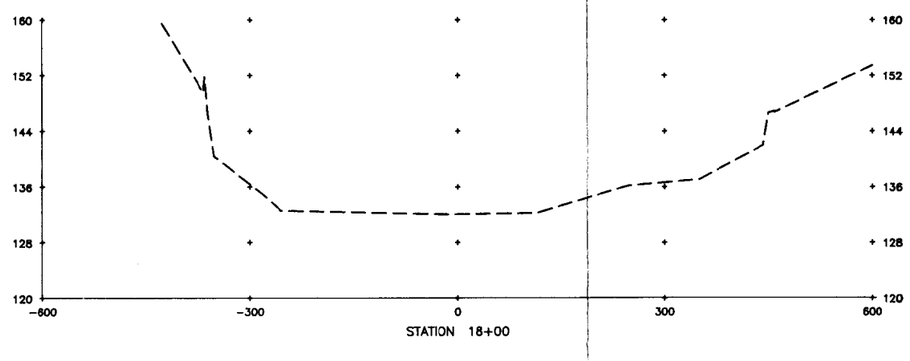
STATION 13+50



STATION 19+50



STATION 12+00



STATION 18+00

NOTE: ELEVATION REF.
APPROX. N.G.V.D. OF 1929
TOP OF SPILLWAY ELEV.=142.3

SCALE: 1 inch = 100 feet Horizontal; 1 inch = 10 feet Vertical

ARMY CORPS OF ENGINEERS
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PROJECT: CROSS SECTIONS OF
UNION POND
MANCHESTER CONNECTICUT
DATE: JUNE 29,1989
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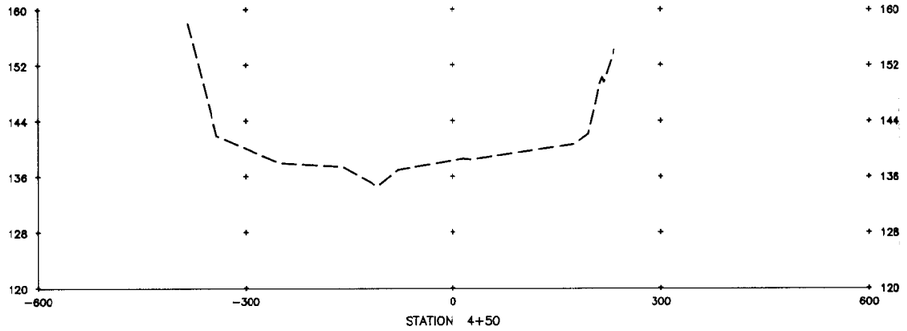
FIGURE B-4A

BASELINE "A"



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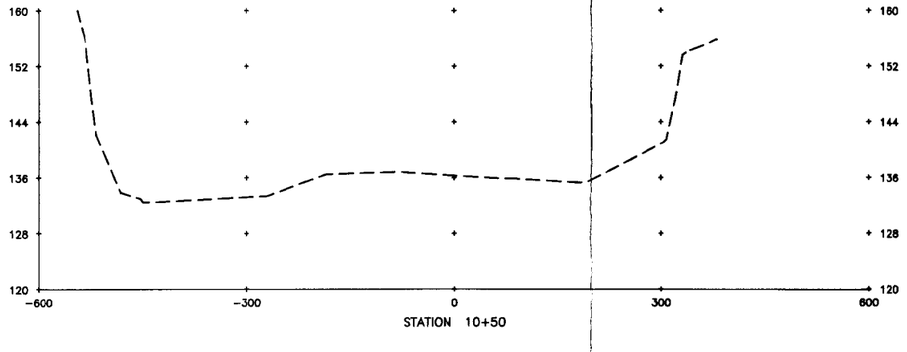
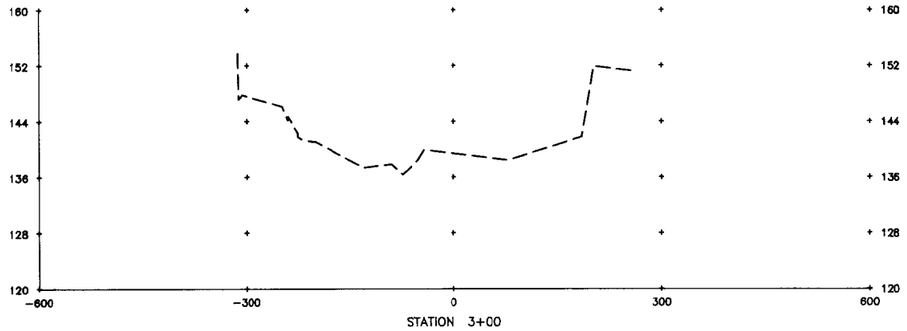
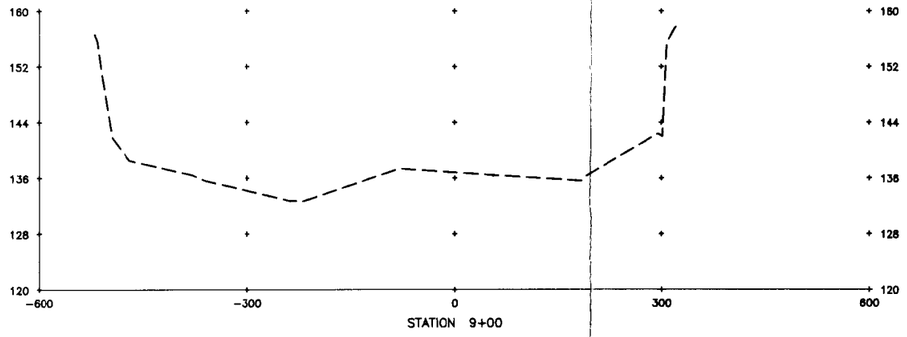


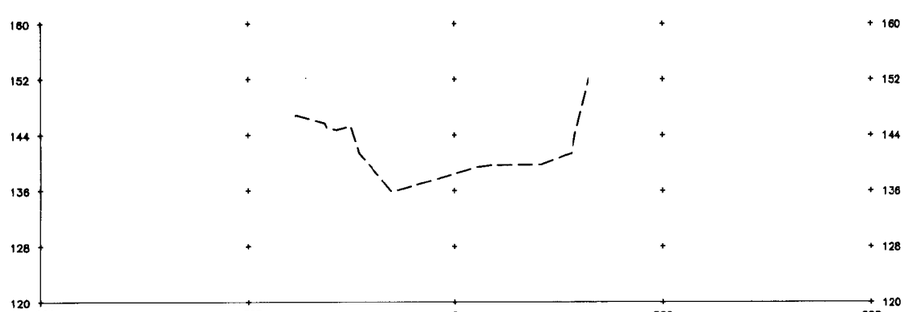
STATION 10+50



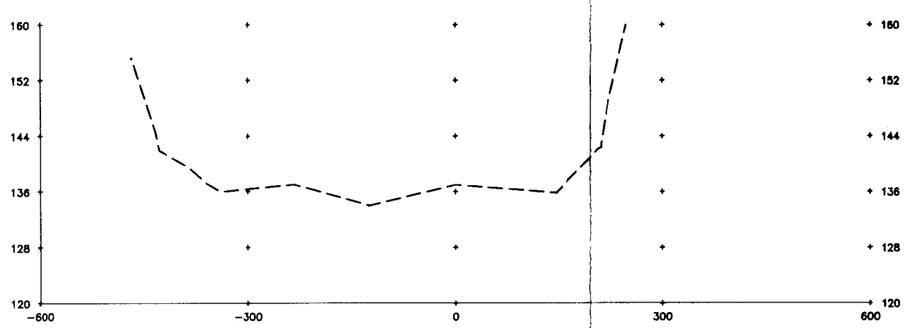
STATION 3+00



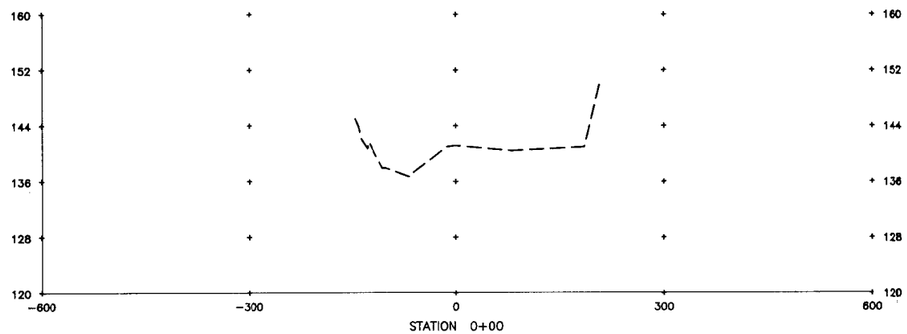
STATION 9+00



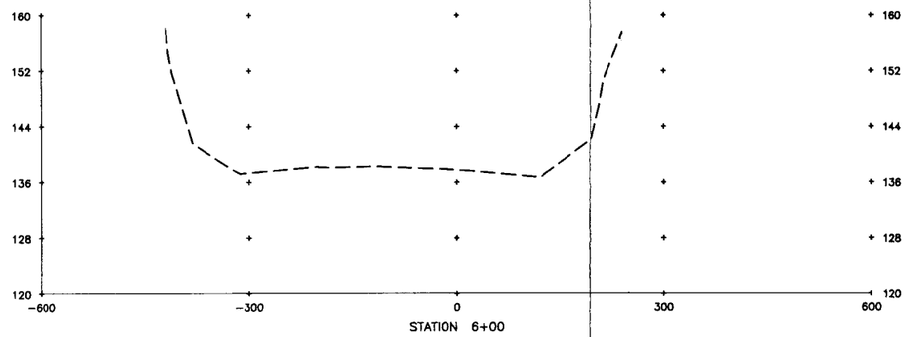
STATION 1+50



STATION 7+50



STATION 0+00



STATION 6+00

NOTE: ELEVATION REF.
APPROX. N.G.V.D. OF 1929
TOP OF SPILLWAY ELEV.=142.3

SCALE: 1 inch = 100 feet Horizontal; 1 inch = 10 feet Vertical

ARMY CORPS OF ENGINEERS
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UNION POND
MANCHESTER CONNECTICUT
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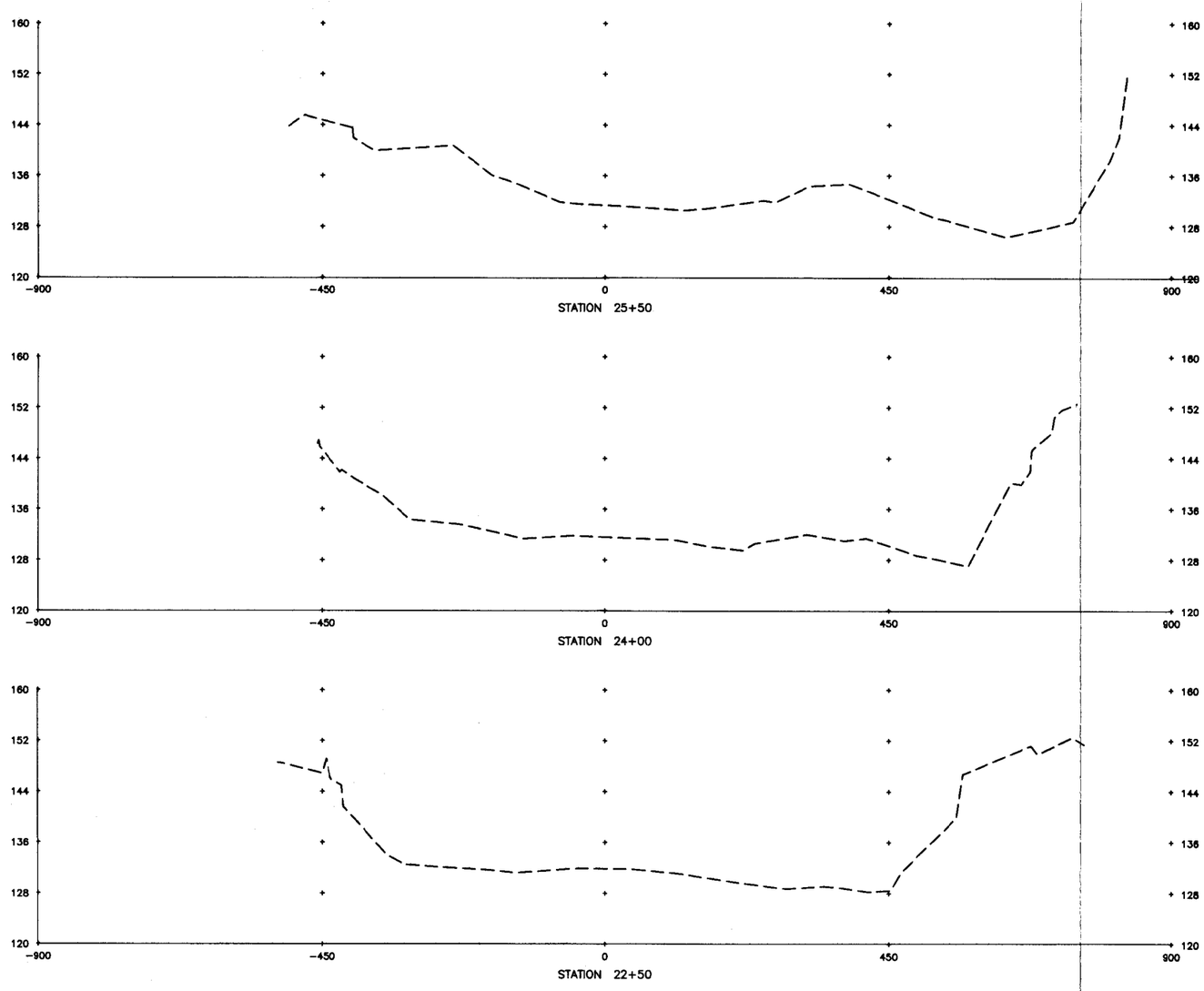
FIGURE B-4B

BASELINE "A"



SCALE: 1 inch = 100 feet Horizontal; 1 inch = 10 feet Vertical

NOTE: ELEVATION REF.
APPROX. N.G.V.D. OF 1929
TOP OF SPILLWAY ELEV.=142.3

SAFETY PAYS

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Dunn Engineering CO.; INC.
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UNION POND
MANCHESTER CONNECTICUT
DATE: JUNE 29,1989
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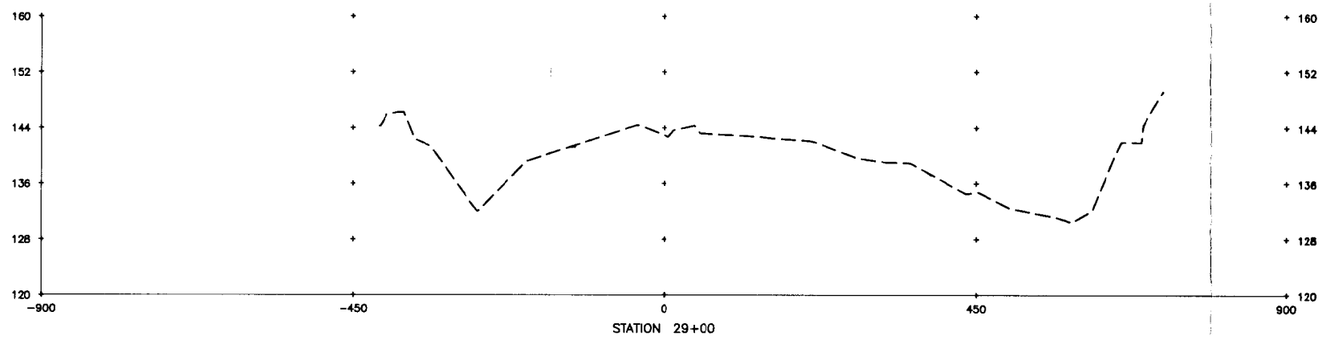
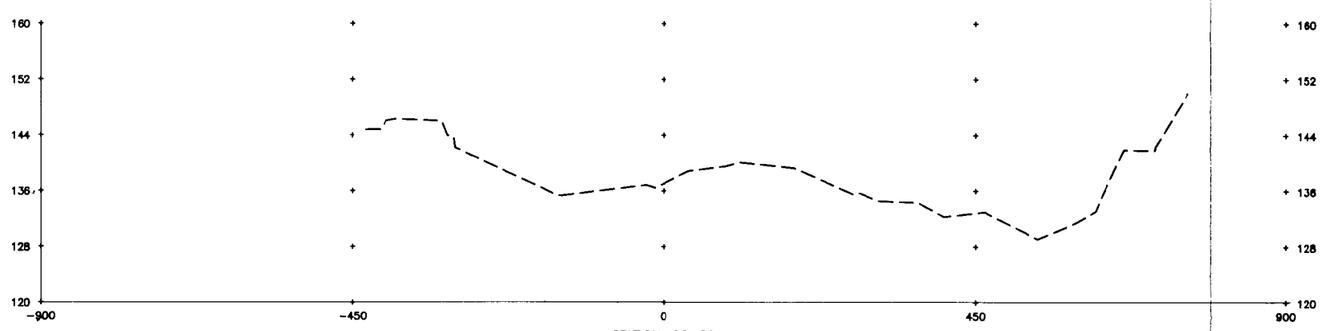
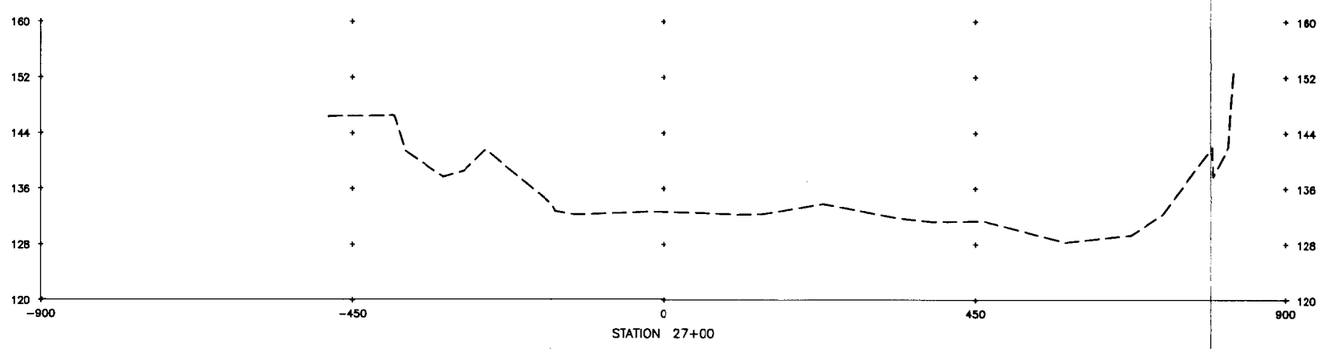
FIGURE B-4C

BASELINE "A"







SCALE: 1 inch = 100 feet Horizontal; 1 inch = 10 feet Vertical

NOTE: ELEVATION REF.
APPROX. N.G.V.D. OF 1929
TOP OF SPILLWAY ELEV.=142.3

SAFETY PAYS

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Dunn Engineering CO.; INC.
Delivery Order No. 12
PROJECT: CROSS SECTIONS OF
UNOIN POND
MANCHESTER CONNECTICUT
DATE: JUNE 29,1989
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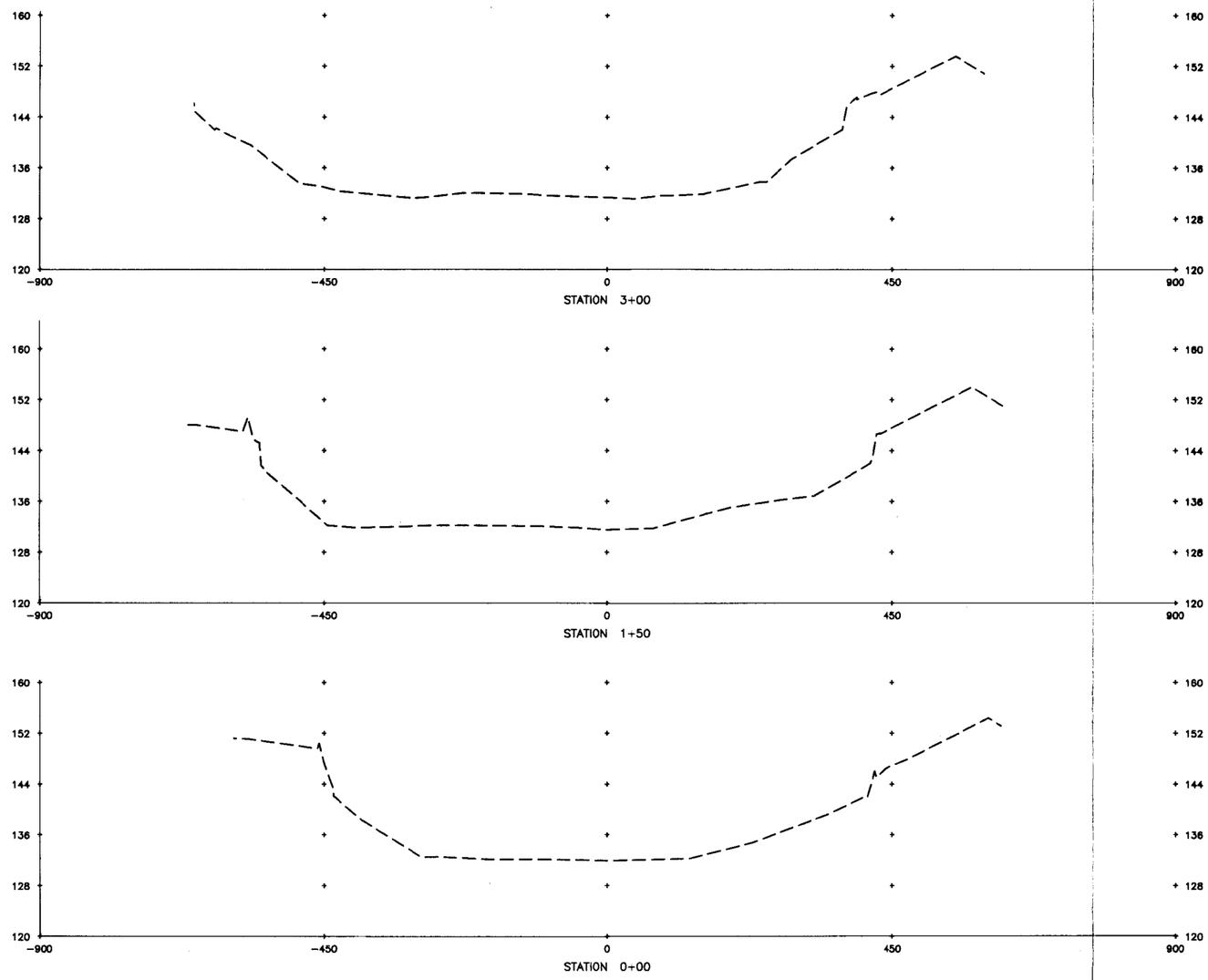
FIGURE B-4D

BASELINE "B"



SCALE: 1 inch = 100 feet Horizontal; 1 inch = 10 feet Vertical

NOTE: ELEVATION REF.
APPROX. N.G.V.D. OF 1929
TOP OF SPILLWAY ELEV.=142.3

SAFETY PAYS

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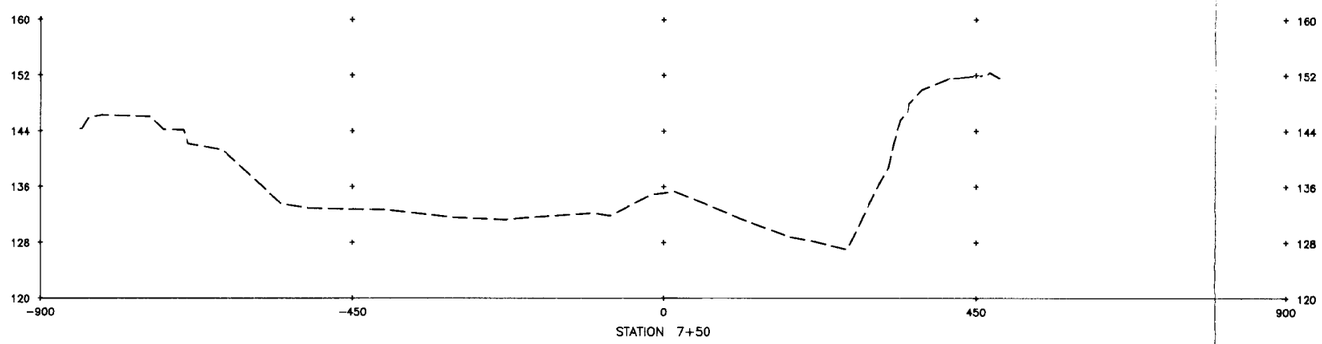
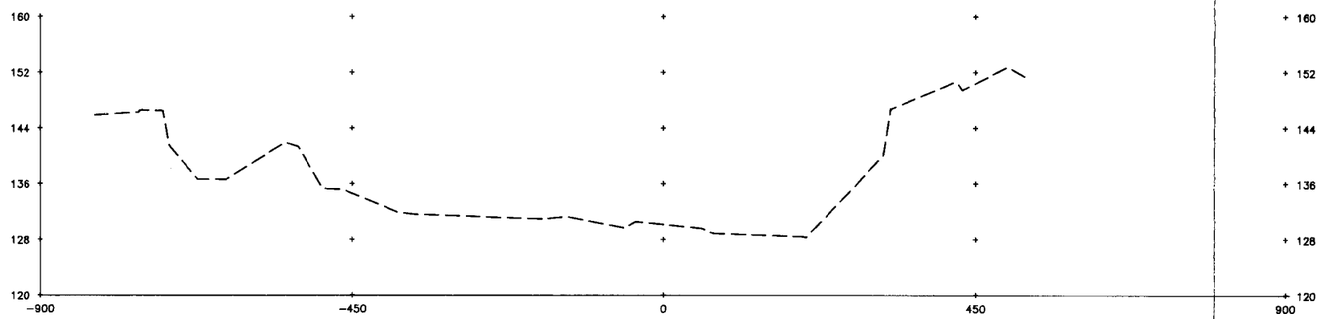
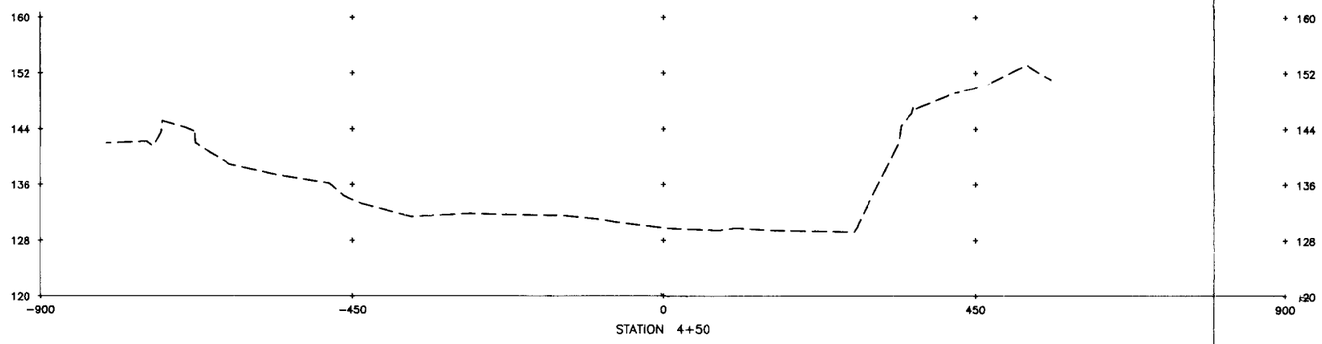
FIGURE B-4E

BASELINE "B"







SCALE: 1 inch = 100 feet Horizontal; 1 inch = 10 feet Vertical

NOTE: ELEVATION REF.
APPROX. N.G.V.D. OF 1929
TOP OF SPILLWAY ELEV.=142.3

SAFETY PAYS

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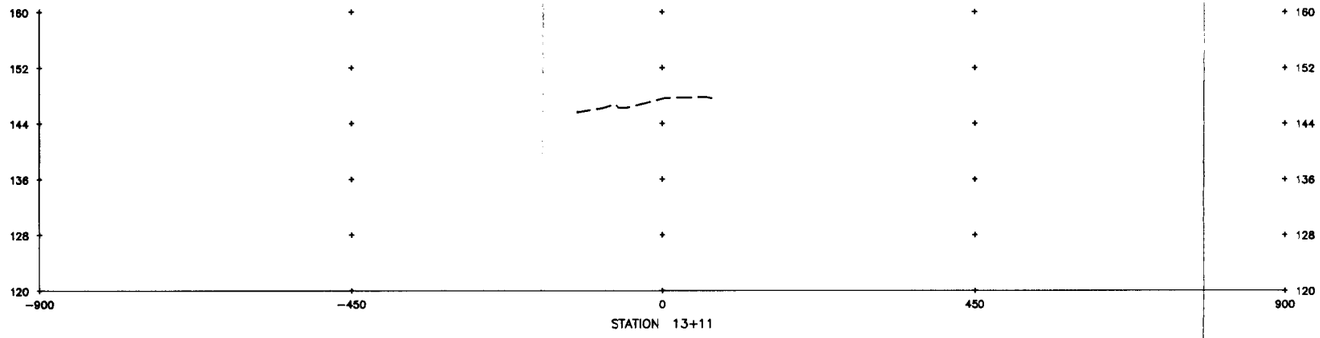
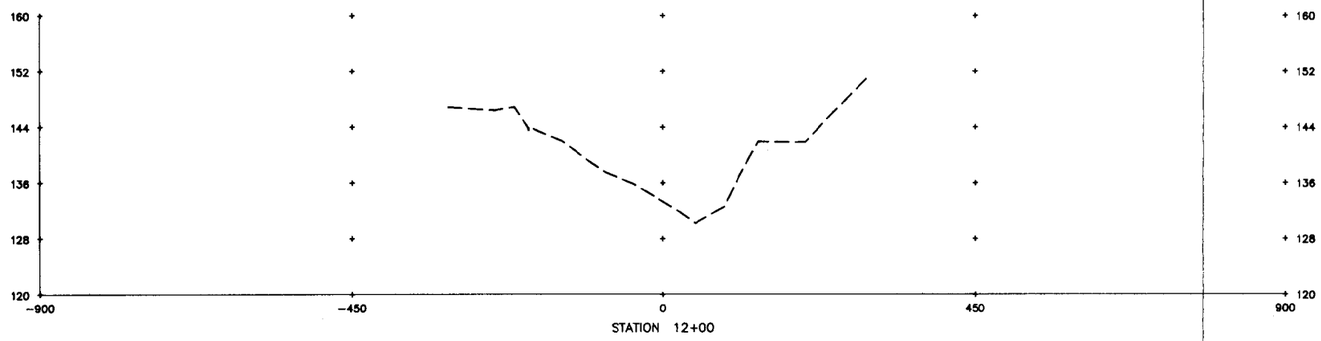
FIGURE B-4F

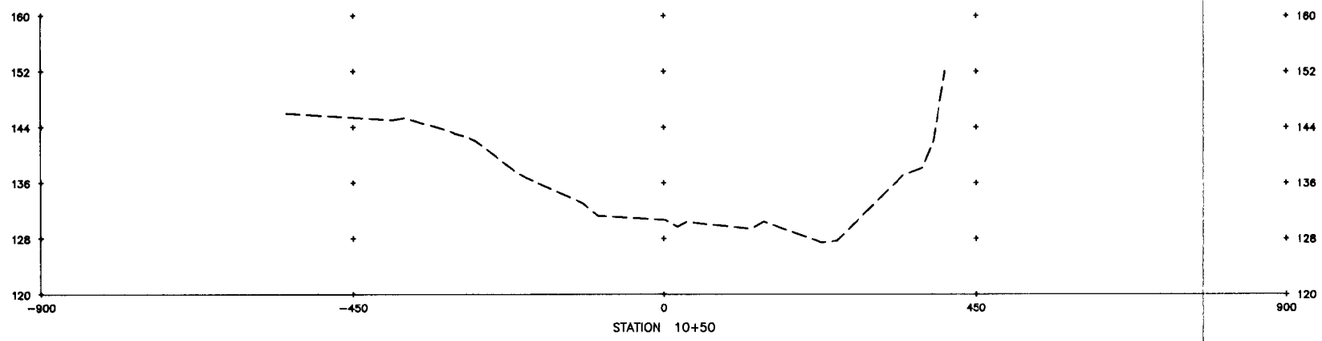
BASELINE "B"



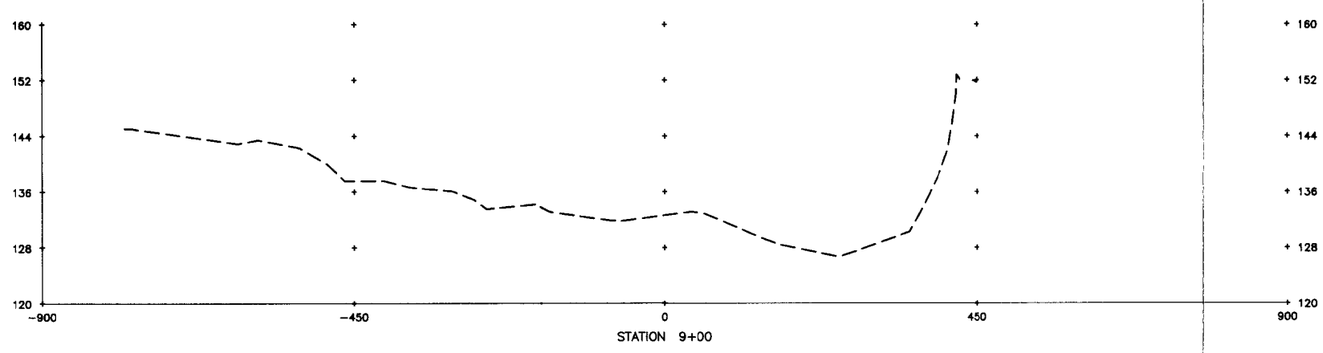
STATION 13+11



STATION 12+00



STATION 10+50



STATION 9+00

SCALE: 1 inch = 100 feet Horizontal; 1 inch = 10 feet Vertical

NOTE: ELEVATION REF.
APPROX. N.G.V.D. OF 1929
TOP OF SPILLWAY ELEV.=142.3

SAFETY PAYS

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FIGURE B-4G

HOCKANUM RIVER AT UNION POND
MANCHESTER, CONNECTICUT

NAVIGATION IMPROVEMENT PROJECT
RECONNAISSANCE REPORT

APPENDIX C

INSPECTION REPORT
UNION POND DAM

JUNE 1989

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS 02254-9149

SUMMARY

As part of a Reconnaissance Phase Investigation for a Section 107 Small Navigation Project at Union Pond in Manchester, Connecticut, New England Division conducted a visual inspection at Union Pond Dam to determine its present condition and to identify any changes since the February 1979 Phase I Inspection Report performed under the National Dam Inspection Program. The February 1979 report classified the dam as "unsafe" and having a "seriously inadequate spillway"; however, local and State governments completed significant repairs in 1988. The dam would form the pool for any future Federal navigation project.

The dam appears to be in fair to poor condition. Stability of the dam has been improved due to the installation of rock anchors and replacement of deteriorated concrete during 1988 rehabilitation work.

The lack of indepth engineering data did not allow for a definitive review. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily upon visual inspection, past performance history, and sound engineering judgement.

Areas of concern include heavy deterioration of the downstream face of unrepaired sections of the spillway and seepage emanating from these deteriorated portions. Seepage trapped in the dam or upper exposed foundation materials will freeze and thaw during the winter season. The expansion and contraction from these freeze and thaw cycles will increase deterioration of the dam, resulting in a geotechnically "unsafe" condition.

The following measures should be undertaken by the dam's owner:

a. Aside from the 90 linear feet of dam (proceeding from the left abutment) rehabilitated during 1988, the remaining length of the 290-foot long dam should immediately undergo a rehabilitation of its deteriorated concrete on the downstream face. Associated seepage and stability conditions should also be evaluated in detail.

b. Evaluate the 42-inch diameter low level outlet and consider making it operable.

c. Consider removing the vertical pipes along the spillway crest.

d. Review the recommendations outlined in the 1979 National Dam Inspection Phase I Report and immediately implement any which remain to be addressed.

Finally, a hydrologic and hydraulic spillway design flood analysis should be on file with the dam's owner.

INSPECTION REPORT
UNION POND DAM
HOCKANUM RIVER
MANCHESTER, CONNECTICUT

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PREFACE

This inspection report was prepared as part of a Section 107 - Small Navigation Project, Reconnaissance Phase Investigation for Union Pond located on the Hockanum River in Manchester, Connecticut. The purpose of this inspection was to assess the present integrity of Union Pond Dam which will form the pool for any potential Federal navigation project on the pond. A previous inspection report, prepared in February 1979 by the Corps of Engineers under the National Dam Inspection Program, found the dam to be "unsafe" with "stability of the structure" appearing "to be marginal based on existing data." As well, the spillway was identified as "seriously inadequate."

The intent of this report is to reassess the dam's condition in light of recent repairs, identify the remaining deficiencies, and recommend any future analysis or improvements for evaluation. Duplication of material in the February 1979 Inspection Report has been kept to a minimum with emphasis mainly on changed conditions.

Assessment of the general condition of the dam is based upon available data and visual inspection. Detailed investigation and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of this investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. Since the reservoir was lowered prior to inspection, such action, while improving the stability, safety and visibility of the dam, removes normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent its condition at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

INSPECTION REPORT
UNION POND DAM
HOCKANUM RIVER
MANCHESTER, CONNECTICUT

SECTION 107
SMALL NAVIGATION PROJECT
RECONNAISSANCE PHASE INVESTIGATION

PROJECT INFORMATION

1.1 GENERAL

The National Dam Inspection Program, Phase I Inspection Report, prepared by New England Division in February 1979, states that Union Pond Dam (CT00013) is situated at the site of one of Connecticut's first paper mills (see location maps, plates 1 and 2). Date of the original dam construction is unknown. The dam was raised to its present height in 1901. In 1972, repairs were carried out on the structure by the town of Manchester and the State of Connecticut. During the summer of 1988, additional repairs were completed as a result of the Corps of Engineers February 1979 inspection report which classified the dam as "unsafe".

Recently, in response to a Congressional request, the Corps began a Section 107 Small Navigation Project, Reconnaissance Phase Investigation for Union Pond. Since the dam will provide the pool required for navigation, it was determined that the present condition of the dam should be evaluated by a multidisciplinary team of hydraulic, structural and geotechnical engineers. Deficiencies remaining since the 1979 inspection would be identified.

1.2 DESCRIPTION OF PROJECT

a. Description of Existing Dam and Appurtenances. The dam is an "L"-shaped concrete gravity structure, with a total length of approximately 590 feet including the earth dike, with the left and right portions of the spillway being approximately 194 and 104 feet in length, respectively. The spillway is a broad crested weir of trapezoidal cross section consisting of an outer concrete shell over an inner earth and rubble core. The existing dam was built over the original dam which was founded on a bedrock ridge.

The spillway crest is 5.7 feet below the top of the dam abutments. Prior to the 1988 rehabilitation work, there were

four outlets from the dam. There is a 42-inch low level outlet (invert elevation approximately 117.1 feet NGVD) at the right end of the spillway. This gate was opened by the use of jacks when the pond was lowered for repairs in 1972. At the extreme left end of the spillway, there are two intermediate level sluice gates through the dam, both of which outlet at approximately elevation 130.1 feet NGVD. Both gates are now operational as a result of the 1988 rehabilitation work. The outlets are approximately 2 feet by 3 feet in size.

The fourth outlet was situated in the gatehouse at the extreme left end of the dam between the left dam abutment and the earth dike. The outlet fed a cast iron conduit 9 feet in diameter with an invert elevation of 127.5 feet NGVD and ran under Union Street and flowed back into the river further downstream. Rehabilitation work during 1988 capped and backfilled this outlet and demolished the existing gatehouse structure.

To the left of the intermediate level sluice gates is an earth dike, which is approximately 200 feet long and with a crest elevation of 148.0 feet NGVD.

b. Location. The dam is located on the Hockanum River in a suburban area of the town of Manchester, County of Hartford, Connecticut (see plates 1 and 2).

c. Ownership. Town of Manchester, CT
41 Center Street
Manchester, Connecticut
Mr. William Camosci
(203) 647-3152

d. Operator. None

e. Hydrologic Conditions. Drainage area of the dam is 53.9 square miles of rolling terrain. A large part of the catchment is rural nature with scattered residential development. A portion of the drainage area is made up of the more heavily developed area including the towns of Vernon and Rockville.

At spillway crest and normal pool elevation of 142.3 feet NGVD, surface area of the impoundment is approximately 51.5 acres, with length of pool equaling 3,300 feet and storage at 515 acre-feet. The deepest portion of the pool, located adjacent to the dam, is approximately 20 feet in depth. Average depth throughout the impoundment is close to 10 feet with pool depths in the upstream pond limits approaching 1 to 3 feet.

f. Purpose of Dam. The dam was owned previously by the Cheney Brothers and the Connecticut Power Company. Present ownership by the town of Manchester limits usage to recreational activities.

g. Design and Construction History. The date of construction of the original dam is unknown. The dam was raised to its present height, and the gatehouse and 9-foot diameter conduit were added in 1901.

In 1972, repairs to the dam were undertaken. Loose or deteriorated concrete on both the upstream and downstream faces of the dam was jackhammered and removed. Voids in the dam were filled by pressure grouting. Facing of the dam was made with wire mesh and gunite. Holes were drilled approximately 20 feet into the lower portion of the present dam and into the old dam. Reinforcing bars were inserted and grouted or pressure grouted if voids were discovered.

Upon conducting the above work, it was discovered that the core of the dam consisted actually of earth and rubble, rather than a solid concrete core. Subsequently, it was decided to seal the upstream face of the dam by excavating the fill adjacent to the dam and placing 3 inches of gunite over the face. Where this was not feasible, a clay blanket was placed adjacent to the dam extending away from the face up to 50 feet into the pond. Additional reinforcing of the downstream face was recommended, as well as installation of drilled weepholes near the downstream toe of the dam to provide pressure relief within the dam core. In addition, the controlled sluice gates were built and installed during these repairs.

During the summer of 1988, additional rehabilitation work was performed on the dam (see Appendix A for contract drawings). Forty foot long, one-fourth inch "diwadag" rods were drilled 15 feet on center into the spillway crest (18 total). The top 2 by 3 foot portion of the spillway's upstream face was removed and replaced with concrete encased reinforcing stirrups. Seven reinforcing straps/ribs were placed along the spillway's first 90 feet.

The dike was refurbished with a sheet pile cutoff wall along its center. Top of the dike was increased to elevation 148.0 feet NGVD with its upstream side slope protected with riprap placed over a filter fabric. The deteriorated gate structure was demolished and its chamber filled with compacted sand and concrete capped. Prior to the 1988 repairs, the crest was at an approximate elevation of 146.7 feet NGVD.

Both left and right spillway abutments have also been raised to elevation 148.0 feet NGVD using concrete caps approximately 1.7 feet in height.

h. Normal Operational Procedures. The operational intermediate level sluice gates are opened in times of high water or when new construction requires the water level to be lowered. When the pond was drained for the 1972 dam repairs, it was necessary to open the low level waste gate at the right end of the dam by means of special jacking equipment. To our knowledge, it has not been opened since then.

1.3 PERTINENT DATA

a. Discharge at Dam Site. Discharge from the pond is from two intermediate level sluices and one low level waste gate.

Outlet Works:	2 sluices - 2 by 3 foot @ Inlet El. 132± ft. NGVD
	1 42-inch dia. waste gate @ El. 117.7± ft. NGVD
Control Mechanism:	Intermediate sluices by two floor stands
	42-inch dia. waste gate by hand or jack mechanism (inoperable)
Maximum known flood at damsite:	21 inches over the spillway (date unknown)
Ungated spillway capacity at top of the dam:	14,300 cfs @ El. 148.0 ft. NGVD

b. Elevations. (All elevations are based on contract drawings associated with the 1988 rehabilitation work, Appendix A.)

Streambed @ centerline of dam:	114 feet NGVD (approx.)
Normal pool:	142.3 feet NGVD
Spillway crest:	142.3 feet NGVD
Top of Dam:	148.0 feet NGVD

c. Dam.

Type:	Concrete gravity structure and earth dike
Length:	590± feet
Height:	33 feet
Top Width:	6 feet
Side Slopes:	Dam - vertical upstream face

d. Spillway.

Type:	Broad crested concrete weir of trapezoidal cross-section
Length of weir:	194 feet (left section) 104 feet (right section)
Crest Elevation:	142.3 feet NGVD
U/S Channel:	Clay blanket on shallow slope up to 50 feet into reservoir
D/S Channel:	Rock ledge and sand and gravel river bottom

e. Storage.

Normal pool:	515 acre-feet
Spillway crest pool:	515 acre-feet
Top of dam:	720 acre-feet

SECTION 2: VISUAL INSPECTION AND EVALUATION HYDROLOGIC AND HYDRAULIC FEATURES

2.1 GENERAL

a. Purpose. This inspection was undertaken to assess the current condition of Union Pond Dam and to determine the status of previous recommendations outlined in the "Phase I Inspection Report, National Dam Inspection Program, Union Pond Dam, CT 00013," dated February 1979.

b. Background. The visual inspection of Union Pond Dam included a review of the hydrologic and hydraulic features of the project by Jon Szarek of Water Control Branch, Engineering Division. Features of the project inspected were: outlet and inlet works, spillway, abutments, upstream and downstream channel, and dike system.

2.2 OBSERVATIONS AND EVALUATIONS

a. Dam. The pool level, lowered to aid in the inspection (25 April 1989), was approximately 6.0 feet below the top of the dam at approximate elevation 136.3 feet NGVD.

b. Spillway. During the 1988 rehabilitation work at the dam, 90 linear feet of the spillway, proceeding from the left abutment, was fortified by rock anchors (see Appendix A for 1988 rehabilitation work contract drawings). This area is in good condition with minimal concrete cracking.

The remaining crest of the spillway is concrete. The concrete is in fair condition with significant spalling and cracking.

Vertical pipes exist at regular intervals along the crest of the spillway which, if struck by debris during heavy overflow, could contribute to localized instability of the top portion of the crest.

c. Abutments. The spillway abutments are vertical concrete walls which were raised approximately 1.7 feet with concrete caps as part of the 1988 rehabilitation work.

d. Upstream Face. As a result of the 1988 rehabilitation work, the upstream face of the spillway crest was reinforced with a 2 by 3 foot area of structural stirrups encased in concrete with a gunite covering. The gunite was in good condition with minimal cracking.

e. Downstream Face. The downstream face of the spillway is exposed to the rock foundation. Except for the 90 foot section of rehabilitation work mentioned in section 2.2b, the spillway shows considerable efflorescence and spalling (see photograph 1). Seepage was observed through cracks in the spillway, through the concrete-rock interface, through the exposed bedrock immediately downstream of the dam, and from weep holes near the toe of the spillway.

f. Outlet Works. Situated to the immediate right of the left dam abutment are two intermediate 2 by 3 foot outlets. The gate valves located on the upstream face of the dam are opened by manually operated mechanisms on the top of the abutment (see photograph 2). Both gates are fully operational.

A low level waste gate is located at the extreme right end of the dam. The 42-inch diameter outlet remains inoperable.

g. Gatehouse. The existing gatehouse was demolished as part of the 1988 rehabilitation. Its chamber was backfilled with compacted sand and capped with concrete. A 9 foot diameter cast iron pipe, which ran from inside the gatehouse chamber and under Union Street before flowing back into the river, was plugged and backfilled.

h. Upstream Channel. Condition of the upstream approach channel is good with no outgrowth of trees or vegetation that could obstruct flow.

i. Downstream Channel. Condition of the downstream channel is good. Trees, which had grown out of the exposed bedrock immediately downstream of the dam, have been cut flush with the bedrock.

j. Dike. The earth dike to the left of the dam was reconstructed with a sheet pile cutoff wall along its center as part of the 1988 rehabilitation work. The upstream slope is protected with riprap situated above filter fabric.

2.3 FLOODING

At the top of the dam, elevation 148.0 feet NGVD, the spillway can pass approximately 14,300 cfs. Prior to the raising of the abutments and dike in 1988, the spillway capacity was 8,400 cfs according to the February 1979 Inspection Report. The Flood Insurance Study for the town of Manchester, prepared in 1982 by the Federal Emergency Management Agency, indicates that the 10, 50, 100 and 500-year

flows at the site are approximately 1,500, 2,700, 3,400 and 5,800 cfs, respectively. Based on the pond's small size and relatively large drainage basin, it can be stated that the dam has no measurable flood control capability or effect.

2.4 SPILLWAY DESIGN FLOOD

No spillway design flood analysis was available for review. However, the February 1979 Inspection Report indicated that the spillway could only pass approximately "twenty-eight percent of one-half the Probable Maximum Flood (PMF)". With the raising of the abutments and dike, the present spillway capacity of approximately 14,300 is about 47 percent of the February 1979 report's one-half PMF outflow (30,500 cfs). It is noted that the estimated spillway capacity to the top of dam of 14,300 cfs represents a runoff rate of 270± csm. This rate is considered a significant hydraulic capacity for the characteristics of the Hockanum watershed.

2.5 CONCLUSIONS AND RECOMMENDATIONS

The overall condition of the hydrologic/hydraulic features of the dam is considered fair. Aside from the 90-foot length of spillway which has been rehabilitated, the downstream face remains in poor condition. It is recommended that the remainder of the downstream face of the spillway be rehabilitated immediately.

The owner should evaluate the 42-inch diameter low level outlet and consider making it operable. As well, consideration should be given to removing the vertical pipes along the spillway crest. A hydrologic and hydraulic spillway design flood analysis for Union Pond Dam should be on file with the dam's owner.

Photo 1: Downstream Spillway Face.

Photo 2: Inlet Works.

Union Pond Dam
Hockanum River, Manchester, CT

Visual Inspection
Structural Features

3.1 General.

a. Purpose: This inspection was made to assess the present condition of the dam and to determine the status of previous recommendations presented in the "Phase I Inspection Report, National Dam Inspection Program, Union Pond Dam (Inventory No. 00013)" dated February 1979.

b. Background: A visual inspection of the project features was made on 25 April 1989: The weather was sunny with noontime temperature at approximately 60 degrees F. To facilitate the inspection, the pool was drawn down approximately six (6) feet below the crest of the dam. Structural features were inspected by Mr. David Descoteaux, U.S. Army Corps of Engineers, New England Division. Observations from this inspection are recorded on the checklist which accompanies this narrative.

3.2 Observations and Evaluations.

Structural Comments pertaining to the dam, gatehouse, and outlets are as follows:

a. Dam: Since the 1979 inspection, ninety (90) linear feet of the dam, proceeding from the left abutment, have been rehabilitated - vertical rock anchors have been installed to secure the dam to the rock foundation and deteriorated concrete on the downstream face has been replaced. The remaining length of the 290-foot long dam has had rock anchors installed, but no repairs have been made to the deteriorated concrete on the downstream face. This rehabilitation work which is depicted on contract drawings entitled "Repairs & Alterations, Union Pond Dam" dated 9 September 1983 (see Appendix A), prepared by Clarence Welti Associates Inc., was performed during the summer of 1988.

The crest of the dam is in good condition with hairline cracking visible in isolated areas, and the exposed portion of the upstream face is also in good condition with no deficiencies to report. Steel pipes, spaced at regular intervals along the crest of the dam, support a wire rope which appears to have served as a safety rail during the rehabilitation work.

The downstream face of the dam is in good to fair condition for the 90-foot length which has been rehabilitated. Typically, areas of new concrete are in good condition while areas of existing concrete are in fair condition with numerous cracks evident. Throughout the rehabilitated length, weep pipes near the toe exhibited steady seepage, and traces of what appears to be clay from the upstream impervious blanket were detected in the pipes.

Over the remaining length of dam where concrete repairs were not made, the downstream face is in poor condition with widespread cracking and spalling. There appears to be some loss of the rubble core of the dam at one severely spalled area. Seepage through the cracks and weep pipes was evident at several locations, although the volume was small.

The right abutment is in good condition with minor cracking, while the left abutment is in fair condition with more extensive cracking and efflorescence. Chain link fence has been installed at both abutments to deter unauthorized access to the dam.

b. Gatehouse: As part of the rehabilitation work on the dam, the gatehouse at the left abutment has been modified as follows: the masonry superstructure, along with the gate mechanisms and support steel, were removed; the intake to the gatehouse was infilled with a concrete wall; the gate to the 9-foot diameter conduit was closed and the interior of the chamber was filled with compacted sand; and finally, the gate chamber was capped with a concrete slab. The condition of the exposed concrete is good with no deficiencies to report.

c. Outlets: The two sluice gates at the left abutment are in good operating condition. The 42-inch diameter low level outlet near the right abutment remains inoperable. As described above, the gate to the 9-foot diameter conduit was closed prior to filling the gate chamber with sand. Additionally, personnel from the town engineer's office reported that the conduit was plugged with concrete downstream of the gatehouse.

3.3 Status of Previous Recommendations.

The status of recommendations pertinent to the structural aspects of the dam made in the 1979 National Dam Inspection Phase I Report is as follows:

a. Recommendation: Investigate stability of the dam and provide methods to correct stability deficiencies and to replace deteriorated concrete.

Status: Stability analyses and methods to rehabilitate deteriorated concrete have been prepared by Clarence Welti Associates, Inc.; documents are filed at the town engineer's office.

b. Recommendation: Investigate the 9-foot diameter conduit and evaluate whether to seal or to renovate the conduit for use as a low level outlet.

Status: No documentation on file at town engineer's office to indicate whether an investigation was made. As described previously, the conduit has been sealed.

c. Recommendation: Institute an annual inspection program.

Status: No inspection reports on file at town engineer's office to indicate that this is being done.

d. Recommendation: The gatehouse should be made completely inaccessible or be removed.

Status: Gatehouse has been removed.

e. Recommendation: The right sluice gate and the low level outlet at the right abutment should be made operable.

Status: The right sluice gate has been made operable, while the low level outlet remains inoperable.

f. Recommendation: Monitor seepage at right abutment and along the toe of the dam - bedrock interface.

Status: No data on file at town engineer's office to indicate that this is being done.

g. Recommendation: The vertical pipes along the crest of the dam should be removed.

Status: No action taken.

3.4 Recommendations and Conclusions.

Based upon this visual inspection, the overall condition of the structural features of the dam is considered to be fair to poor. The condition of the dam has been upgraded somewhat since the 1979 National Dam Inspection Phase I Report, due to the installation of rock anchors which improves the stability of the dam and replacement of deteriorated concrete in the 90-foot length of dam near the left abutment.

Beyond the 90-foot length of dam which has been rehabilitated, the downstream face remains in poor condition. Aside from budgetary constraints, there appears to be no reason why the entire downstream face was not repaired during the rehabilitation work performed in the summer of 1988. It is recommended that the remainder of the downstream face be rehabilitated immediately.

Seepage through the dam, which is evident along its entire length, continues to be of concern. The presence of water within the body of the dam makes both existing and new concrete susceptible to deterioration caused by freeze-thaw action. This water also may promote corrosion of the rock anchors. As previously recommended, seepage should be periodically monitored and observations recorded.

Finally, it is recommended that the recommendations in the 1979 National Dam Inspection Phase I Report which were not addressed be implemented immediately.

STRUCTURAL CHECKLIST FOR UNION POND DAM INSPECTION

AREA EVALUATED	BY	CONDITION
Structural Features		
1. DAM	D.D.	
General Condition of Concrete		Upstream face and crest good. Downstream face good to fair in rehabilitated area, poor elsewhere. See narrative.
Rust or Staining		None observed.
Spalling or Cracking		Downstream face has numerous spalls and cracks. Appears to be some loss of rubble core of the dam at one large spall.
Seepage or Efflorescence		Seepage evident along the entire length of downstream face. Efflorescence evident at both abutments.
Weep Holes		Steady seepage from weep holes near the left abutment with lesser amounts observed elsewhere.
2. GATEHOUSE	D.D.	
General Condition		Masonry superstructure and operating mechanisms removed. Gate chamber filled with sand and capped with concrete.
Spalling or Cracking		None Observed
Visible Reinforcing		None Observed
Rust or Staining		None Observed
Seepage or Efflorescence		None Observed
3. OUTLETS	D.D.	
Sluice Gates at Left Abutment		Both gates in good operating condition
Low Level Outlet at Right Abutment		Inoperable
9-Foot Diameter Conduit		Gate to conduit closed and gate chamber filled with sand. Conduit plugged with concrete downstream of gatehouse.

PHOTO 1 - UPSTREAM FACE OF DAM LOOKING RIGHT ABUTMENT

PHOTO 2 - DOWNSTREAM FACE OF DAM LOOKING TOWARD LEFT ABUTMENT. LENGTH OF DAM WITH BUTTRESSES WAS REHABILITATED IN THE SUMMER OF 1988.

PHOTO 3 - DOWNSTREAM TOE OF DAM NEAR LEFT ABUTMENT

PHOTO 4 - DOWNSTREAM FACE OF DAM NEAR RIGHT ABUTMENT; NOTE CRACKS AND SEEPAGE

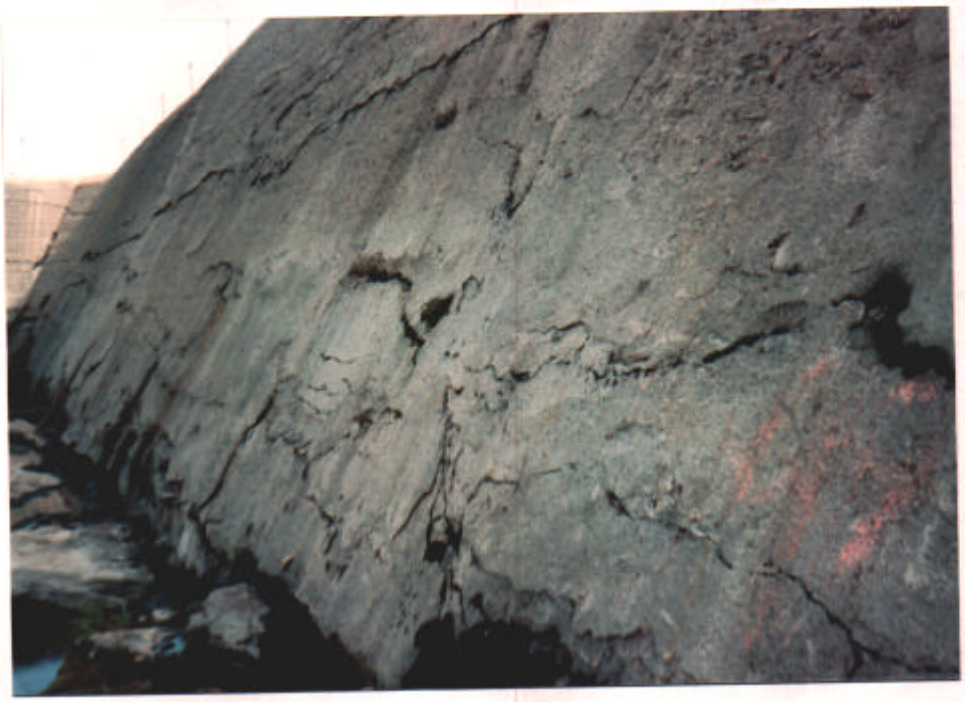


PHOTO 5 - TYPICAL CRACKING ON DOWNSTREAM FACE OF DAM

PHOTO 6 - SPALLED CONCRETE ON DOWNSTREAM FACE; NOTE LOSS OF RUBBLE FROM CORE OF DAM

GEOTECHNICAL INSPECTION REPORT OF UNION POND DAM

HOCKANUM RIVER, MANCHESTER, CONNECTICUT

4.1. PURPOSE AND SCOPE.

The purpose of the inspection was to observe recent repairs to Union Pond Dam, determine whether they are in compliance with past USACE recommendations and decide if the "unsafe" designation can be removed. The inspection included review of the 1979 National Dam Inspection Phase 1 Report for Union Pond Dam, a field examination of the dam, abutments and attached dike, and discussions with local people who supervised the repair work. The scope also included the preparation of the Geotechnical Inspection Report which summarizes existing geotechnical conditions at the dam.

4.2. AUTHORITY.

The geotechnical inspection was authorized as part of the Dam Inspection Report agreed to in DF from Engineering Division to Planning Division dated 12 April 1989.

4.3. INSPECTION TEAM.

Jon Szarek	Hydrology/Hydraulics	CENED-ED-WQ
David Descoteaux	Concrete/Structural	CENED-ED-DG
Paul Schimelfenyg	Geotechnical	CENED-ED-GD

4.4. HISTORY AND DESCRIPTION OF DAM

The dam consists of an "L" shaped concrete gravity spillway with an adjoining earth dike. The dam, including dike, is approximately 590 feet long and the spillway is approximately 33 feet above the Hockanum River. Appurtenant structures to the dam include a 42 inch low level outlet and two 2-foot by 3-foot intermediate level sluice gates.

It appears that the original dam (construction date unknown) was an earth fill embankment that rested on a ridge of weathered Arkose sandstone. The trapezoidal spillway portion of the dam was faced with concrete and raised to its present elevation in 1901. In 1972 repairs to the spillway were performed which included removal of deteriorated concrete on the upstream and downstream faces of the dam, pressure grouting of the remaining voids, facing the dam with wire reinforced gunite, installation of No. 8 reinforcing bars grouted (pressure grouted where voids were encountered) into 2-inch diameter by 20 feet long holes spaced at 10-foot intervals along the spillway crest, placement of 3 inches of gunite on the upstream face of the dam, and placement of a clay blanket from the dam as much as 52 feet upstream. The latest repairs to the dam were performed during the summer of 1988. The major items were installation of 18 tensioned tie-downs along the spillway crest, removal and replacement of concrete on one-third of the downstream side of the spillway, reconstruction of the attached dike with a sheet pile cutoff wall along the centerline and stone protection on the upstream side, removal of the trees downstream from the spillway, and closure of the 9-foot diameter low level conduit from the gate house.

4.5. ASSESSMENT

A visual inspection of Union Pond Dam and dike was performed on 25 April 1989. The pool had been drawn down to facilitate inspection of the upstream and downstream toes. The following is a list of geotechnical concerns raised during the inspection:

a. The downstream portion of the spillway which was not repaired in 1988 has horizontal cracks up to 1 inch wide and spaced as close as 4 inches. Some of the cracks extend the entire length of the spillway. Surficial holes up to 2 feet in long dimension were also noted in the downstream face. Core material was visible in some of the holes. Seepage was noted exiting from the cracks and holes during the inspection.

b. The Arkose sandstone foundation is highly weathered. Horizontal joint spacings sometimes less than 1 inch were observed in the sandstone. It appears that seepage exits from the sandstone downstream from the dam.

c. A small amount of seepage was observed at the right abutment and dam interface.

d. Holes and depressions were noted in the clay blanket. They could be entrance areas for seepage.

e. The root systems for the trees cut below the spillway will eventually rot leaving potential seepage paths.

4.6. STATUS OF PAST GEOTECHNICAL RELATED RECOMMENDATIONS

The 1979 National Dam Inspection Phase 1 Report for Union Pond Dam identified several geotechnical related concerns. Their status is discussed below.

a. Concern: The heavy deterioration of the downstream face of the spillway and seepage emanating from these deteriorated portion.

Status: Approximately one-third of the heavy deterioration was alleviated during the latest repair program. The remaining two-thirds of the heavy deterioration should also be repaired.

b. Concern: Trees growing on the earthen dike near the gatehouse should be removed.

Status: The trees have been removed.

c. Concern: The low areas of the earthen dike, particularly adjacent to the fence around the gatehouse, should be raised to the same elevation as the top of the dam.

Status: The dike has been reconstructed and its new crest is at approximately the top of the dam elevation.

d. Concern: Contact seeps at the right dam abutment and along the toe of the dam. Bedrock interface should be monitored regularly for significant increases in seepage volume not related to fluctuations of the pond water level.

Status: The seeps continue to occur. Monitoring should continue.

e. Concern: Round-the-clock surveillance should be provided by the owner during periods of unusually heavy precipitation.

Status: Round-the-clock surveillance is still needed during periods of heavy precipitation.

f. Concern: A program of inspection by a registered professional engineer qualified in dam inspection should be instituted on an annual basis. The inspections should be technical in nature, and should include the operation of the outlet works.

Status: Annual dam inspections performed by a qualified registered professional engineer should be continued.

g. Concern: Deterioration of the gate structure and the remaining 9 foot diameter conduit could cause serious erosion of the dike, the left abutment of the dam, the left bridge abutment to the Union Street bridge or Union Street.

Status: The gatehouse and conduit have been filled with concrete and sand.

4.7. CONCLUSIONS

Existing and potential seepage problems were identified at Union Pond Dam during the National Dam Inspection and this inspection. Seepage which is trapped in the dam or the upper exposed foundation materials will freeze and thaw during the winter. The expansion and contraction from the freeze and thaw cycles will increase the rate of deterioration of the dam. Although the town of Manchester has expended considerable resources in repairs to the dam which have alleviated some of the seepage problems and have increased the safety level of the dam, the remaining seepage problems are still cause for considerable concern. Therefore, from a geotechnical stand point it is recommended that the "unsafe" designation be maintained for Union Pond Dam.

5.1 CONCLUSIONS AND RECOMMENDATIONS

The dam appears to be in fair to poor condition. Stability of the dam has been improved due to the installation of rock anchors and replacement of deteriorated concrete during the 1988 rehabilitation work.

The lack of indepth engineering data did not allow for a definitive review. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily upon visual inspection, past performance history, and sound engineering judgement.

Areas of concern on the dam include heavy deterioration of the downstream face of unrepaired sections of the spillway and seepage emanating from these deteriorated portions. Seepage trapped in the dam or upper exposed foundation materials will freeze and thaw during the winter season. Expansion and contraction from these freeze and thaw cycles will increase deterioration of the dam resulting in a geotechnically "unsafe" condition.

The following measures should be undertaken by the dam's owner:

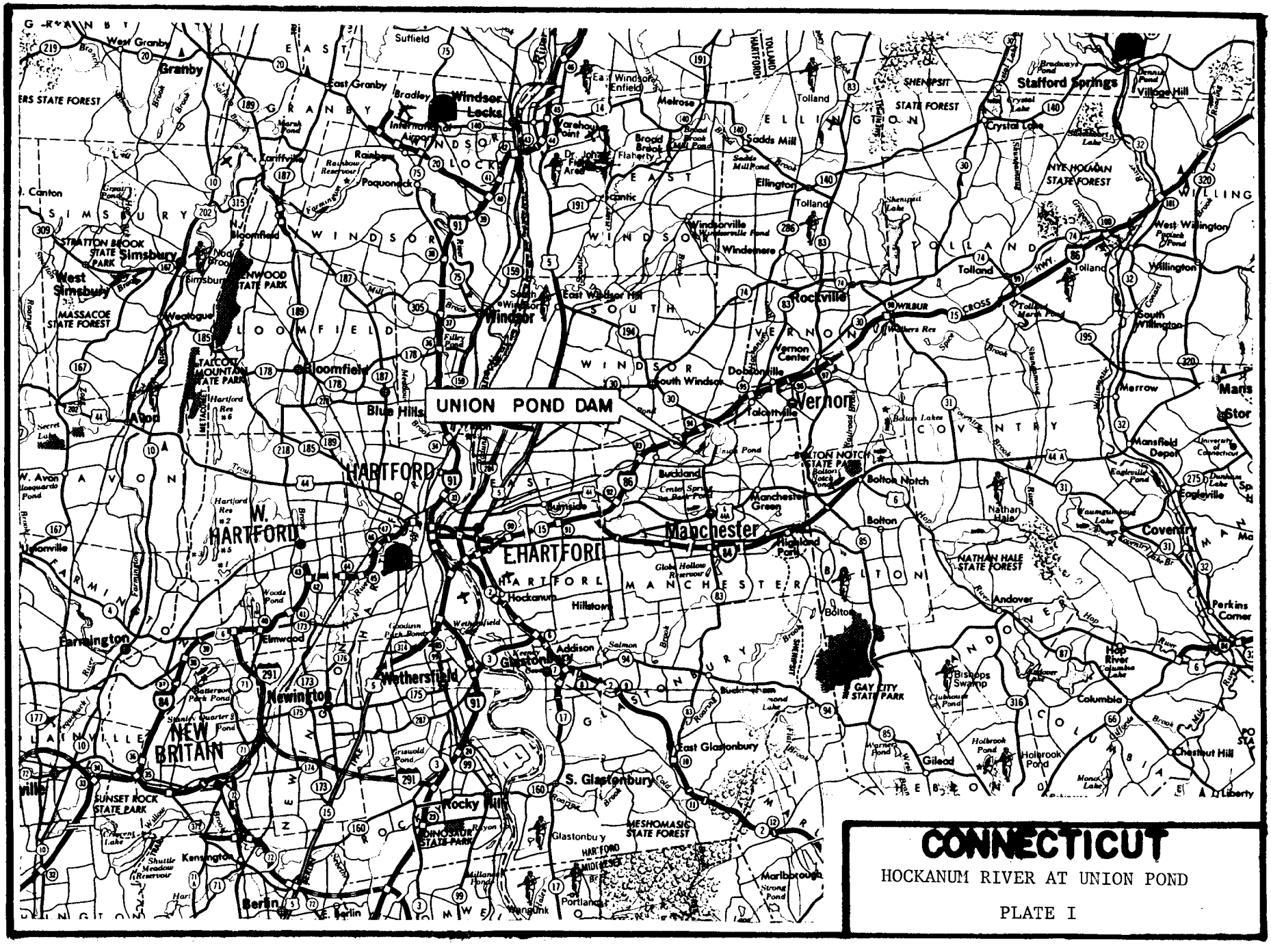
a. Aside from the 90 linear feet of dam (proceeding from the left abutment) rehabilitated during 1988, the remaining length of the 290-foot dam should immediately undergo a rehabilitation of its deteriorated concrete on the downstream face. Associated seepage and stability conditions should also be evaluated in detail.

b. Evaluate the 42-inch diameter low level outlet and consider making it operable.

c. Consider removing the vertical pipes along the spillway crest.

d. Review recommendations outlined in the 1979 National Dam Inspection Phase I Report and immediately implement any which remain to be addressed.

Finally, a hydrologic and hydraulic spillway design flood analysis should be on file with the dam's owner.


UNION POND DAM
CONNECTICUT
HOCKANUM RIVER AT UNION POND
PLATE I

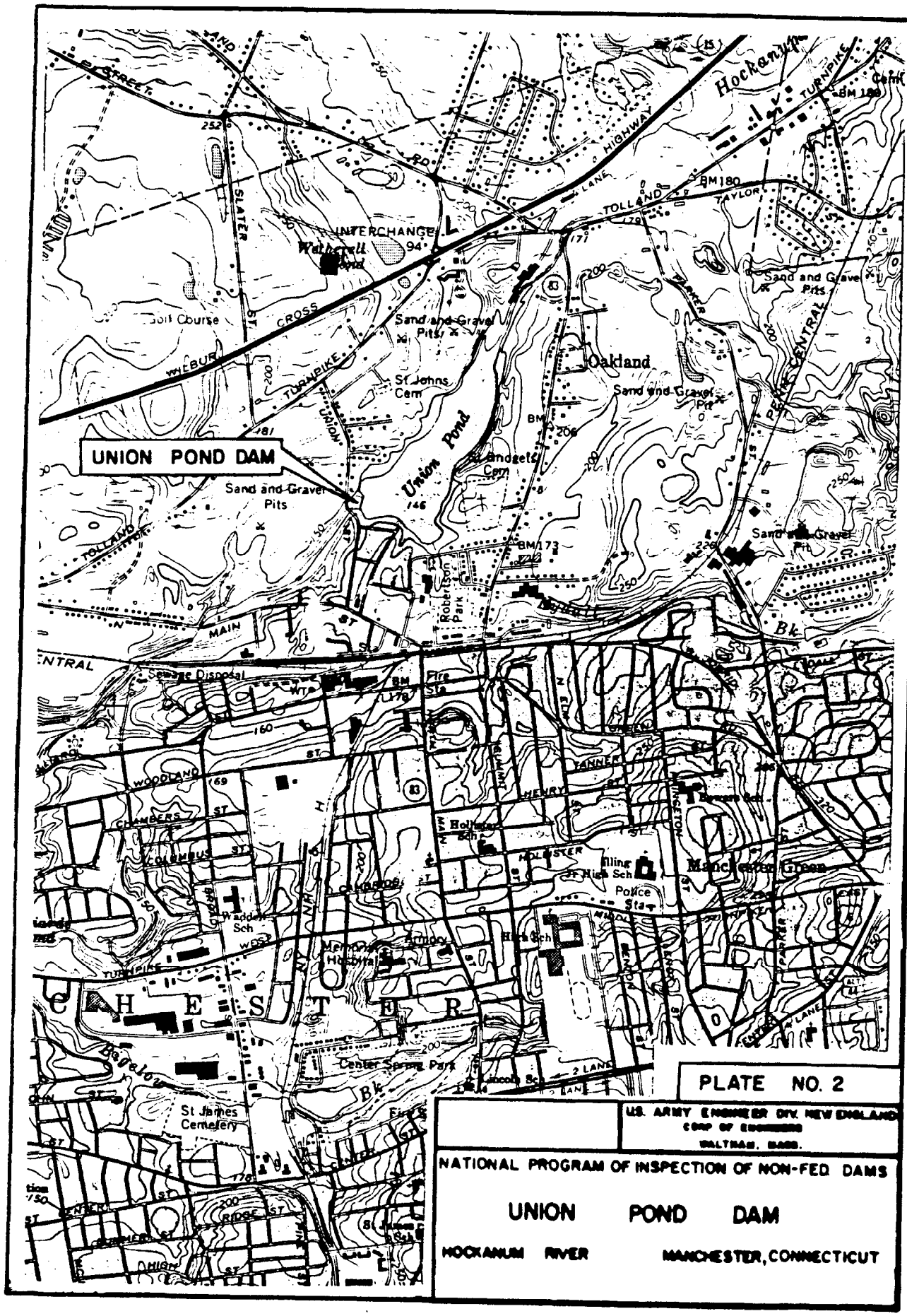


PLATE NO. 2

U.S. ARMY ENGINEER DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS

UNION POND DAM

HOCKANUM RIVER MANCHESTER, CONNECTICUT

APPENDIX C

INSPECTION REPORT
UNION POND DAM

APPENDIX 1

CONTRACT DRAWINGS

1988 UNION POND DAM REHABILITATION

Hydrologic & Hydraulic Data	
Watershed Area	53.9 Square Miles
Watershed Length	97,600 Ft
Design Storm	1/2 Probable Maximum Flood
	9.8" in 6 Hours
	12.8" in 24 Hours
Maximum Flow at Dam	14,620 C.F.S. 24 Hrs After Storm Start
	9 Hrs of Flow in Excess of 12,000 C.F.S.

Length of Spillway	300'±
Spillway Formula	$Q = LCH^{3/2}$
Spillway Coeficient	C = 3.75* * Corrected Spillway
Capacity @ H = 5.6'	14,900 C.F.S. (Elev 147.9)
Top of Spillway	Elev 142.3
Top of Dike	Elev 148.0

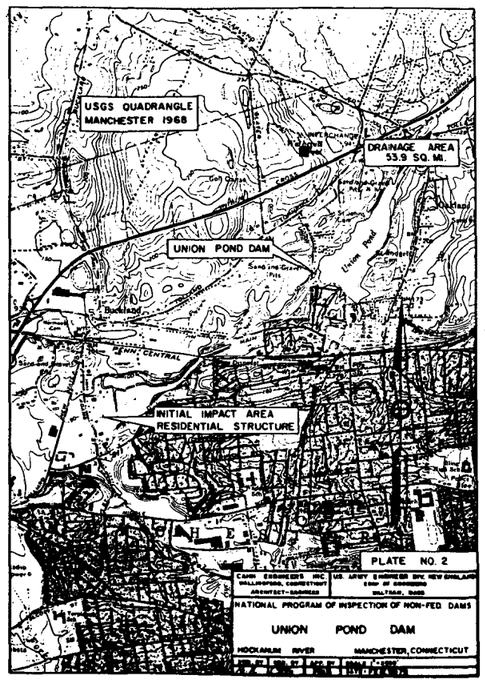
Partial Estimate of Construction Quantities	
1	Steel Sheeting-Permanent - 2,000 S.F. PMA22
2	Sheeting-Temporary - 400± S.F. Contractor Design
3	Dike Concrete - 45 ± C.Y.
4	Concrete Removal-Toe & Spillway - 75 ± C.Y.
5	Line Drilling - 520 L.F. 3" Dia x 2' Deep
6	Concrete Removal-Top of Spillway - 135 ± C.Y.
7	Grouting & Jacking Diwadag Rods
8	New Concrete Spillway-Toe & Sides - 100 ± C.Y.
9	New Concrete Spillway-Top - 150 ± C.Y.
10	Drilling For Diwadag Rods - 3" Dia - 750 L.F.
11	Drilling For Core Drains - 4" Dia - 300 L.F.
12	Steel Reinforcing - 10 Tons ±
13	Stainless Steel Drains - 400 L.F. 2" Dia Stainless Stl
14	Concrete at Old Valve Chamber - 60 C.Y.
15	Diwadag Rods - 18 @ 40' & Hardware (Nuts & Plates)

Owner:	Town of Manchester Att: George Kandra Town Hall Public Works Dir Manchester, Ct 06040.
Engineer	Clarence Welti Associates Clarence Welti P.E. Glastonbury, Ct 06033.
Submission to D.E.P.	
Revision	
Revision	
Revision	

Town Of Manchester, Ct.

Union Pond Dam

Repairs & Alterations



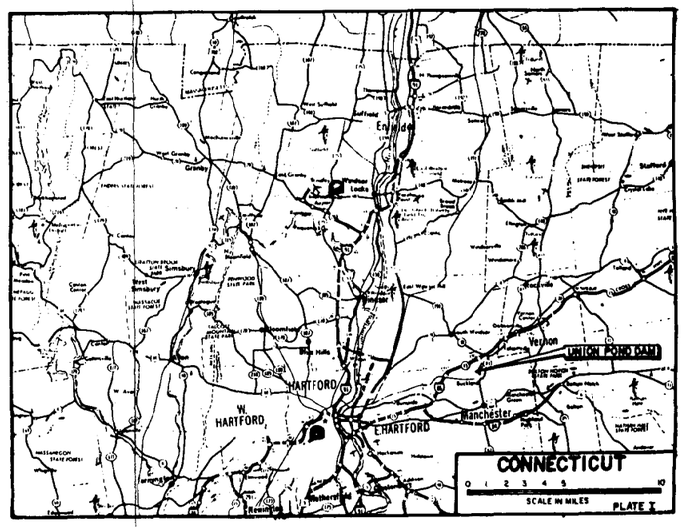


PLATE C-1-1

Magnetic North

Union Street

Property in this Area Possibly Town of Manchester

Conc Walk

Kerry Street

One Story Frame House

Gravel Parking Area

Remove Existing Fence

Replace Existing Fence (shaded line) with new fence to specifications

Remove Loose Portion of Gate Structure (After Lowering Water Level) Fill Chamber With Sand. Compact by Jetting & Vibrating Place Slab on Top of Gatehouse. See Sections

Stainless Steel Drain

New 6' Gate in Fence

Existg Conc Dike

Flow

Excent of Paved Rip Rap

Regrade with 6" Topsoil & Seed

Bit. Conc Drive

Cut & Seal Joint

Regrade with 6" Topsoil & Seed

Remove Existg Paving Replace With 2½" Bitum on 12" Gravel Base

Remove Shed. Reset when Grading Completed

Remove Trees From Site

New Chain Link Type Fence 6' High With 3" Dia Galv Posts 2' Into Conc (shaded line)

Remove Trees On Island

Union Pond

Replace Existg 2' x 3' Gate Remove & Replace Broken & Weathered Concrete Around Gate Structure

Remove Trees from Site. Stumps may be left in Place if Cut Flush

Ledge & Trees

Ledge

Existg Conc Dike

Sta 0

Sta 0+15'

Sta 0+25'

Sta 0+30'

Sta 0+45'

Sta 0+50'

Sta 0+60'

Sta 0+75'

Sta 0+80'

Sta 0+100'

Sta 0+125'

Sta 0+150'

Sta 0+175'

Sta 0+185'

Sta 2

Sta 2+10'

Sta 2+25'

Sta 2+50'

Sta 2+75'

Sta 0+200'

Sta 0+175'

Sta 0+150'

Sta 0+125'

Sta 0+100'

Sta 0+75'

Sta 0+50'

Sta 0+25'

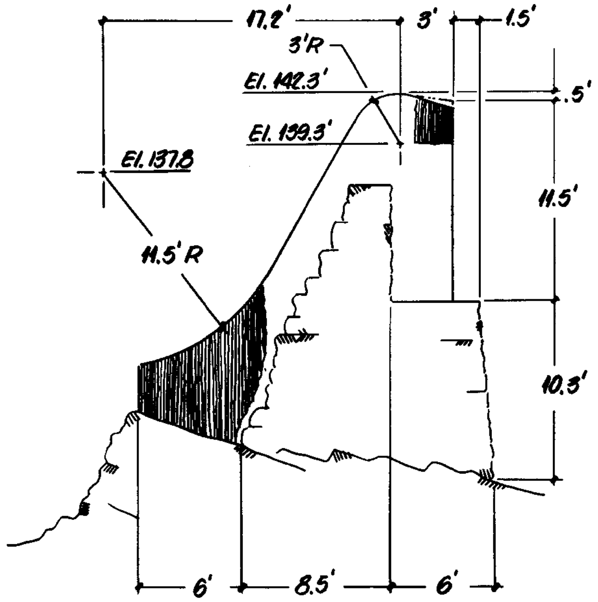
Sta 0

C W A	Town of Manchester, Ct Union Pond Dam Repairs & Alterations
SCALE 1"=20'	Site Plan
DR HOOD/RJ	PROJ NO.
APPROV.	REV DATE
	DATE

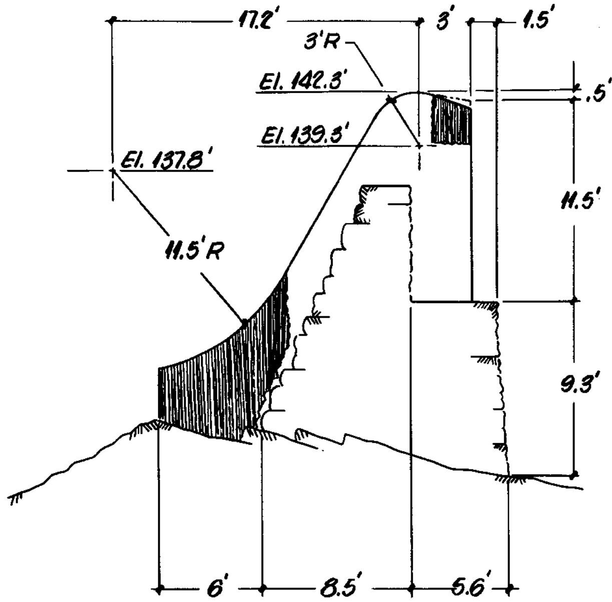
CLARENCE WELTI ASSOCIATES
CLARENCE W WELTI P E
GLASTONBURY CONN 06033

Sheet 1 of 8

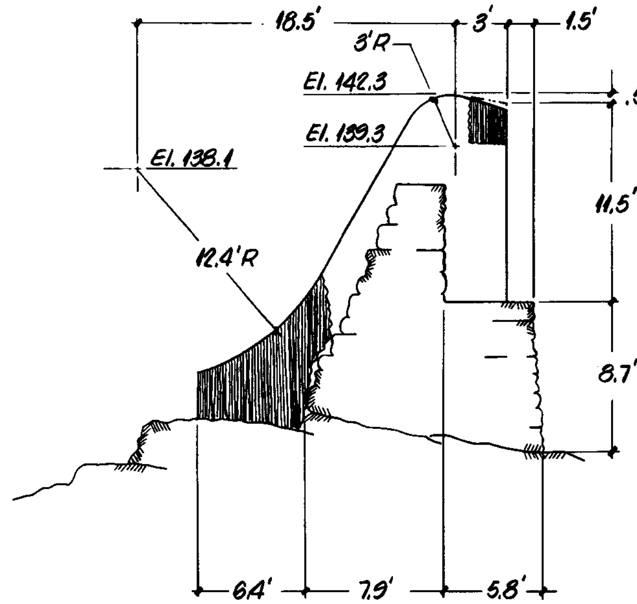
PLATE C-1-2



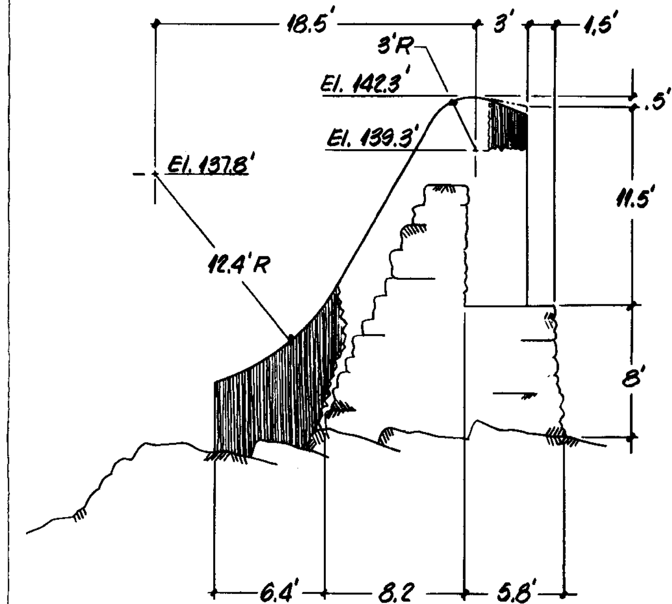
Section A
Station 0+00
Strap Not Shown
1" = 5'



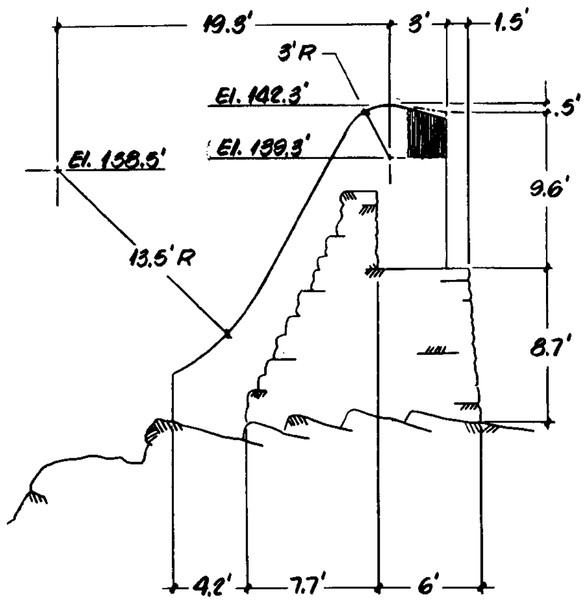
Section B
Station 0+25
1" = 5'



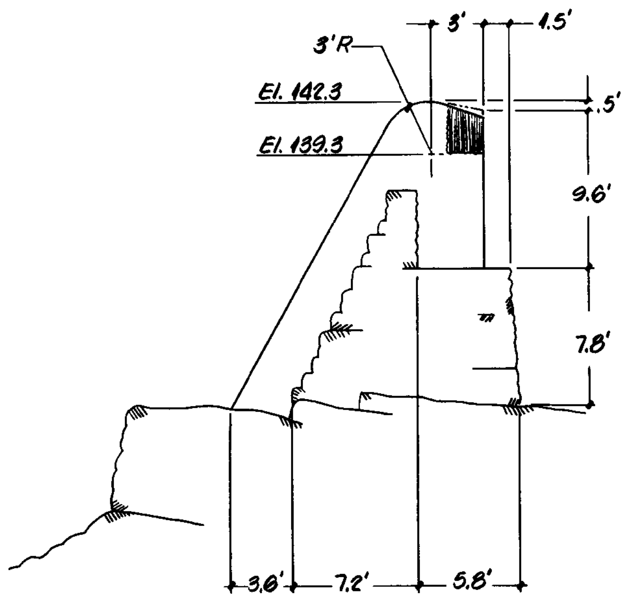
Section C
Station 0+50
1" = 5'



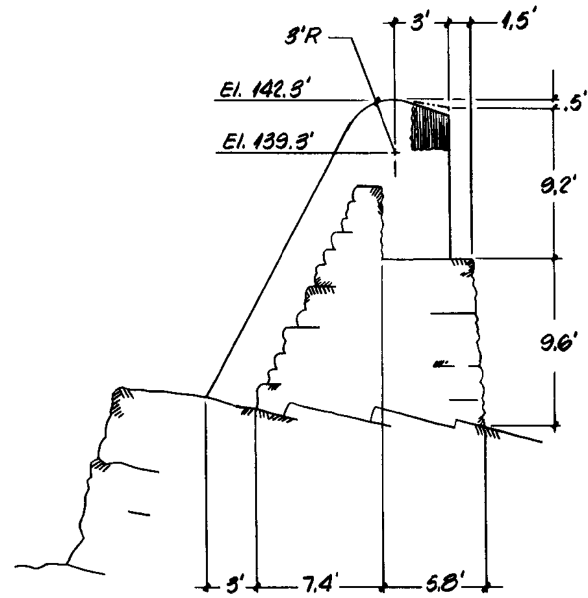
Section D
Station 0+75
Strap Not Shown
1" = 5'



Section E
Station 0+100
1" = 5'



Section F
Station 0+125
1" = 5'



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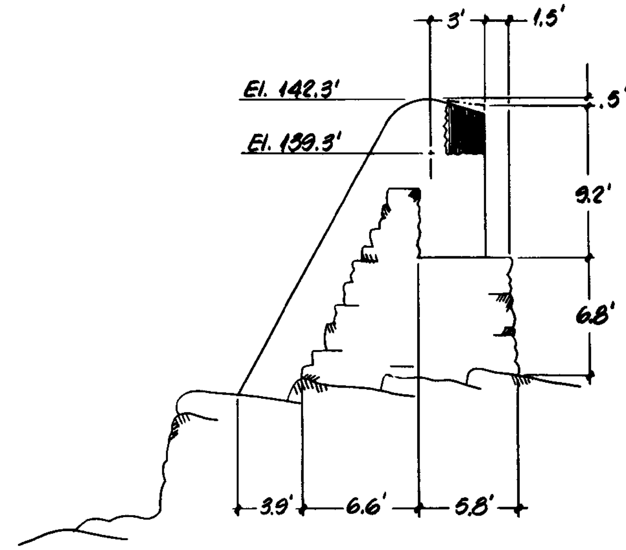

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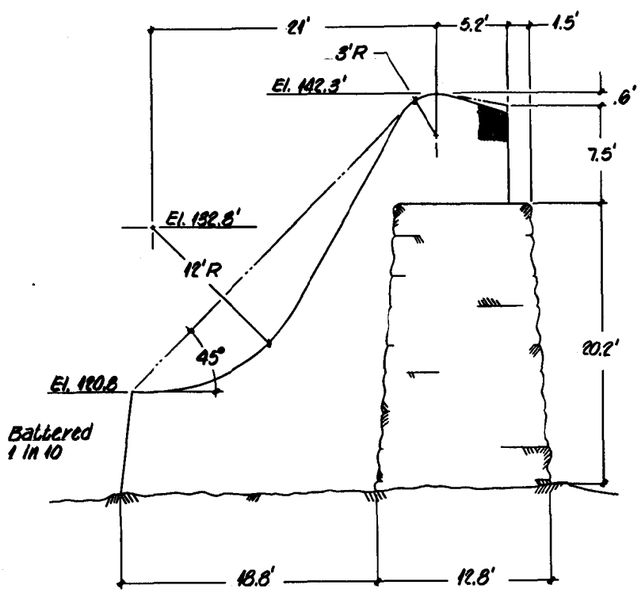
C W A	Town of Manchester, Ct Union Pond Dam Repairs & Alterations	
	Scale 1" = 5' Dr. Approv.	Sections A thru H
	CLARENCE WELTI ASSOCIATES CLARENCE W WELTI P.E. GLASTONBURY CONN 06033 Sheet 2 of 8	



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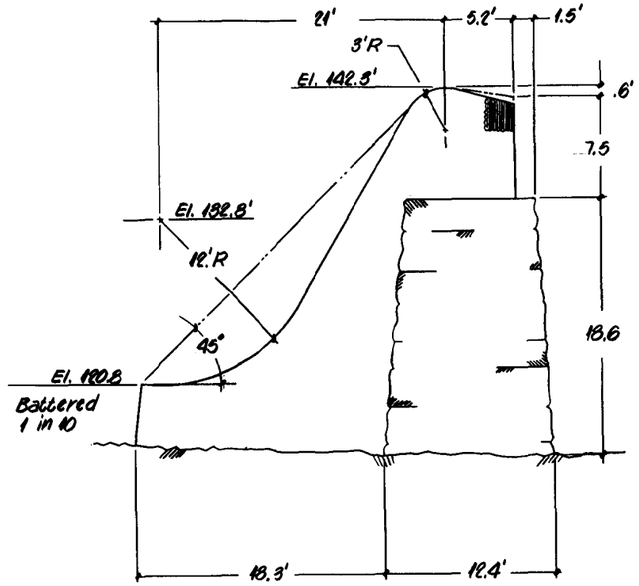

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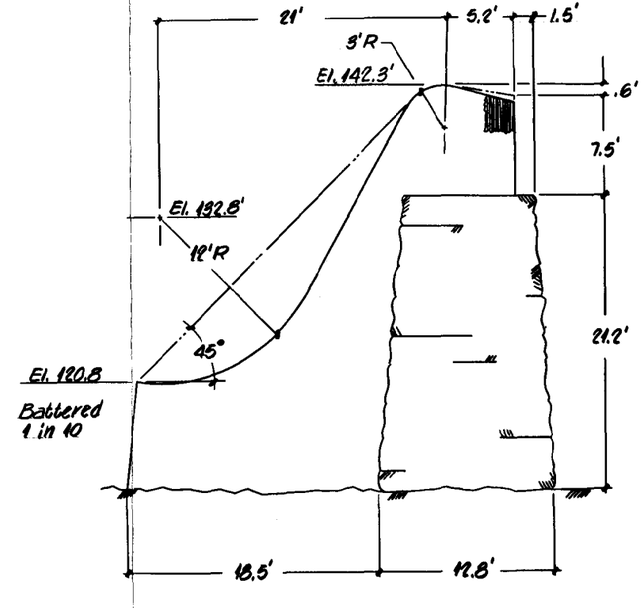

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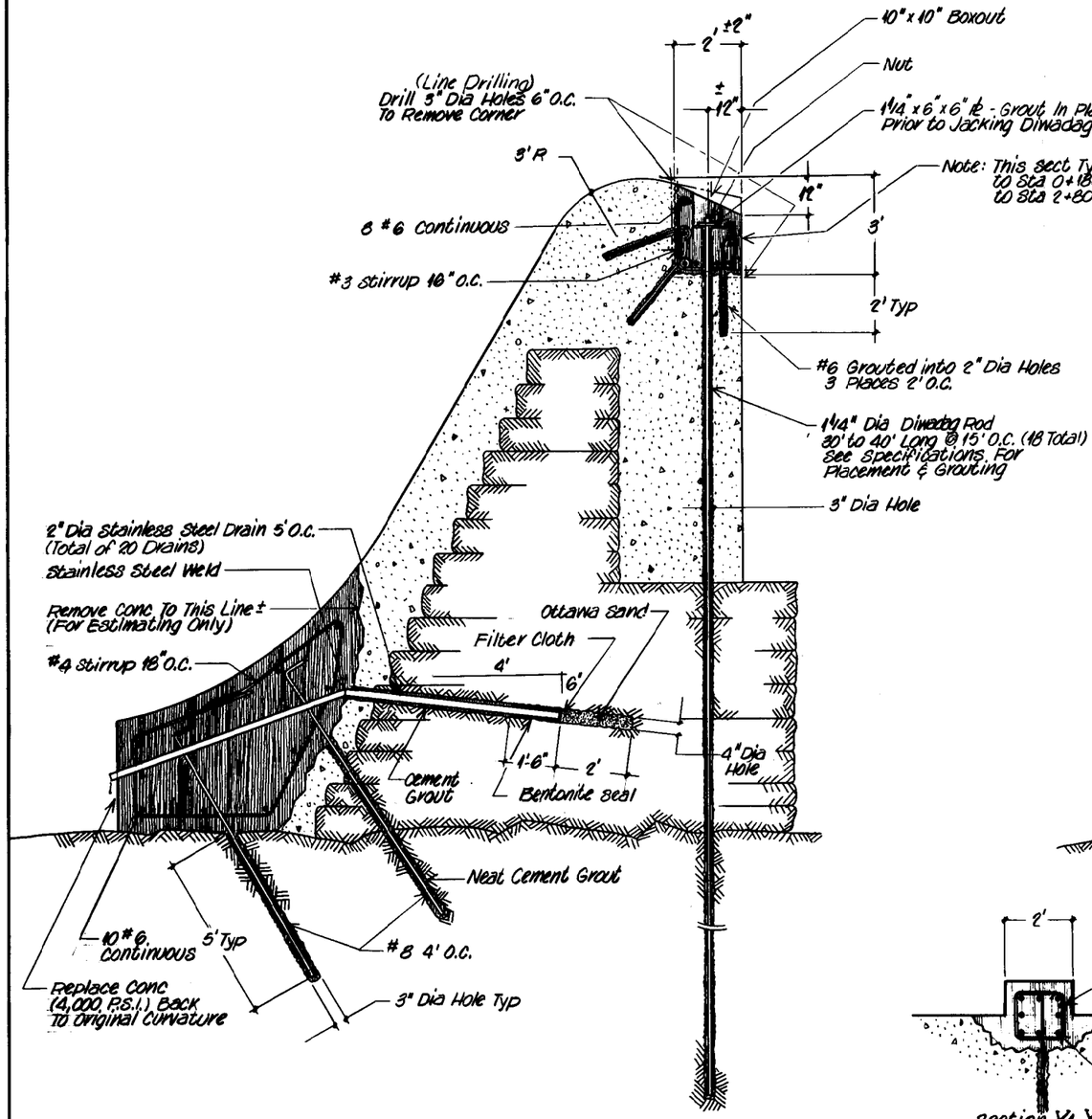
	CLARENCE WELTI ASSOCIATES CLARENCE W. WELTI P.E. GLASTONBURY, CONN. 06033	Sheet 3 of 6

PLATE C-1-4



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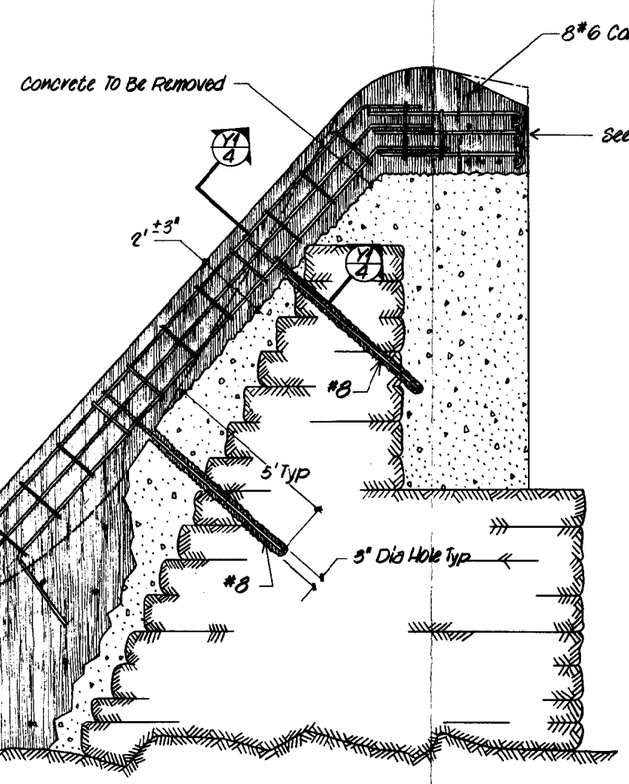

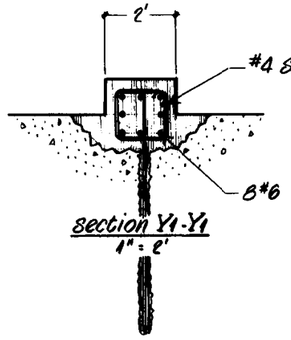

Section Y1-Y1
1" = 2'

Section Y-Y
1" = 2'
Typical Strap
7 Places From Station 0+00' to Station 0+90'

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	SCALE 1"=2'	PROJ NO.
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	APPROV.	DATE
	Sections	
	CLARENCE WELTI ASSOCIATES CLARENCE W. WELTI P.E. GLASTONBURY CONN. 06033	
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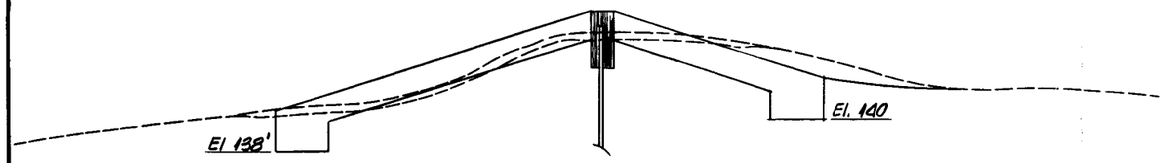
PLATE C-1-5



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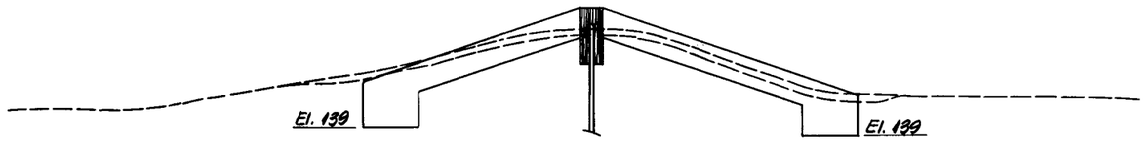

Section P
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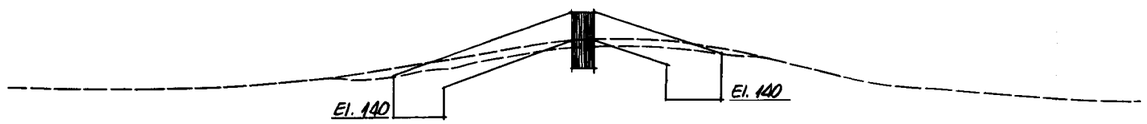
End Sheeting

→ Water



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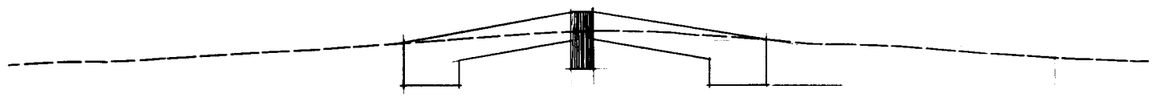

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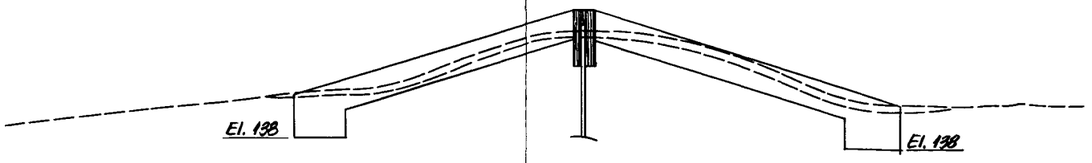

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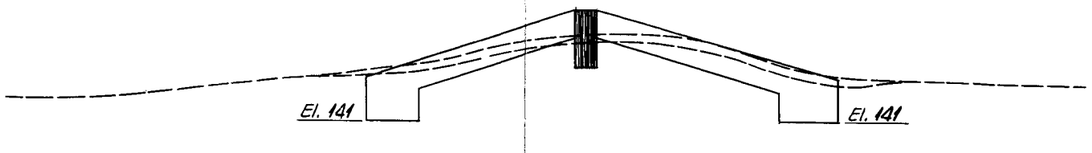

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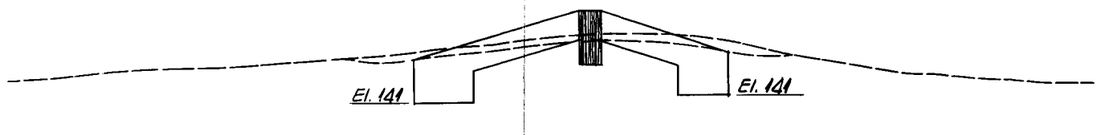
→ Water



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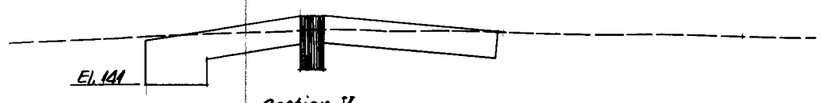

Section V
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C W A	Town of Manchester, Ct Union Pond Dam Repairs & Alterations		
	SCALE 1" = 5'	Sections M thru V	PROJ NO.
	DR		REV DATE
	APPRO.		DATE
	CLARENCE WELTI ASSOCIATES CLARENCE W. WELTI, P.E. GLASTONBURY, CONN. 06033		

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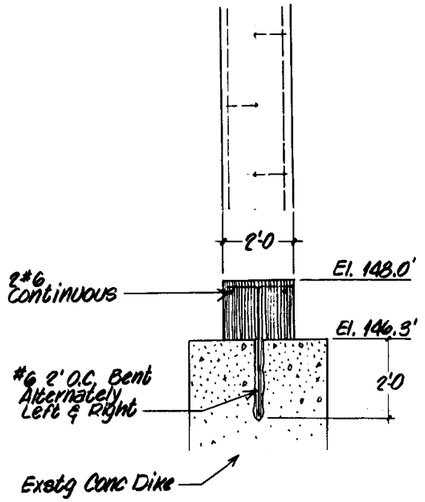
PLATE C-1-6



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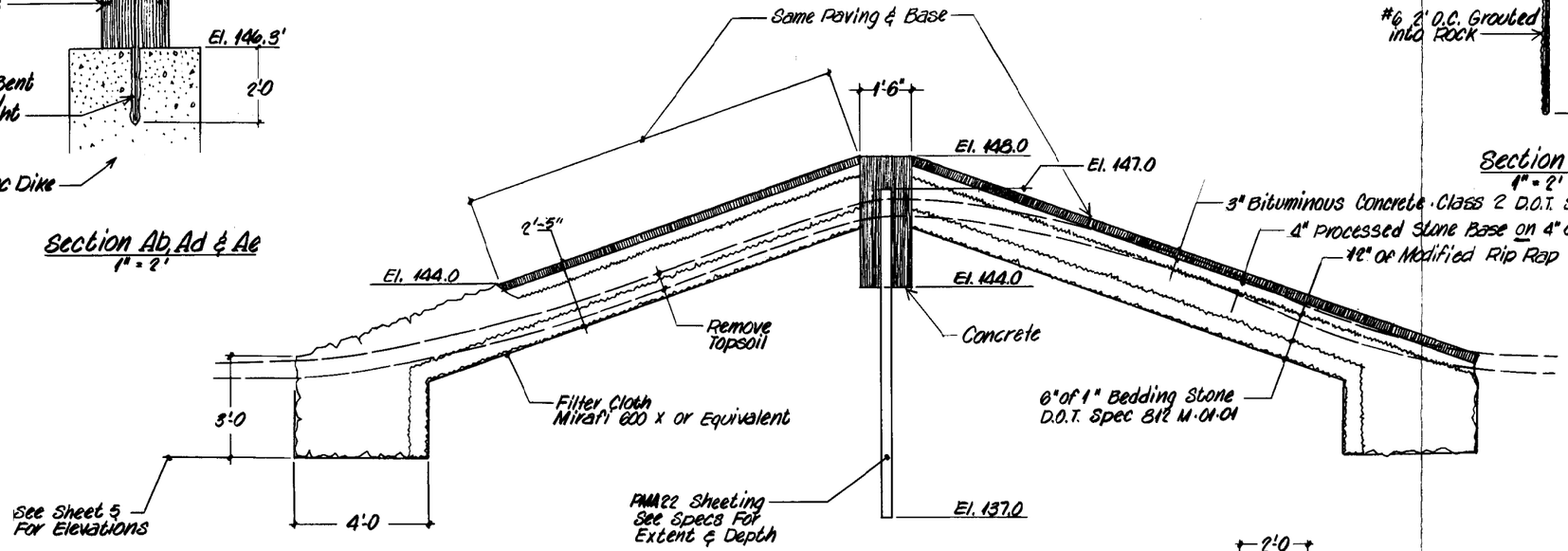

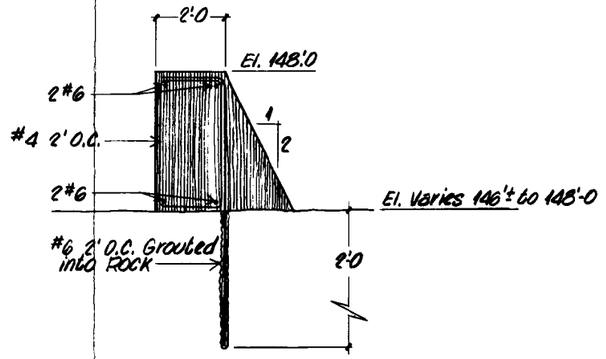

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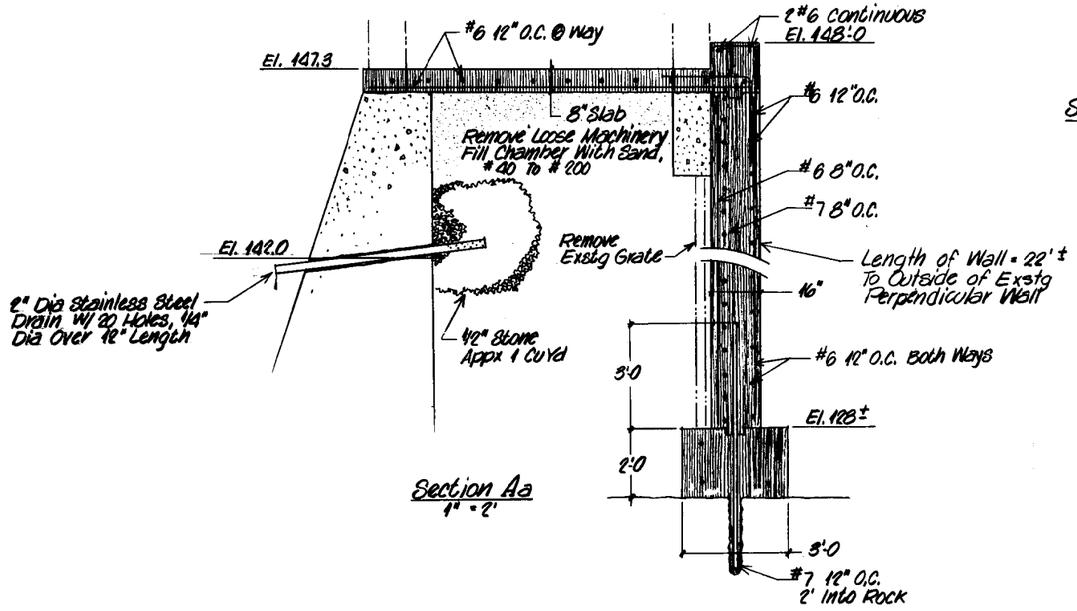

Section Aa
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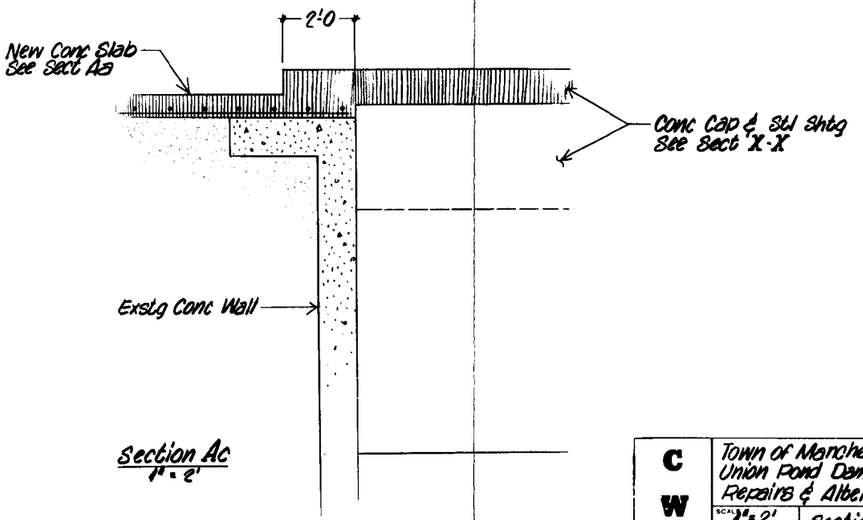
Section X-X
1" = 2'



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		REV. DATE
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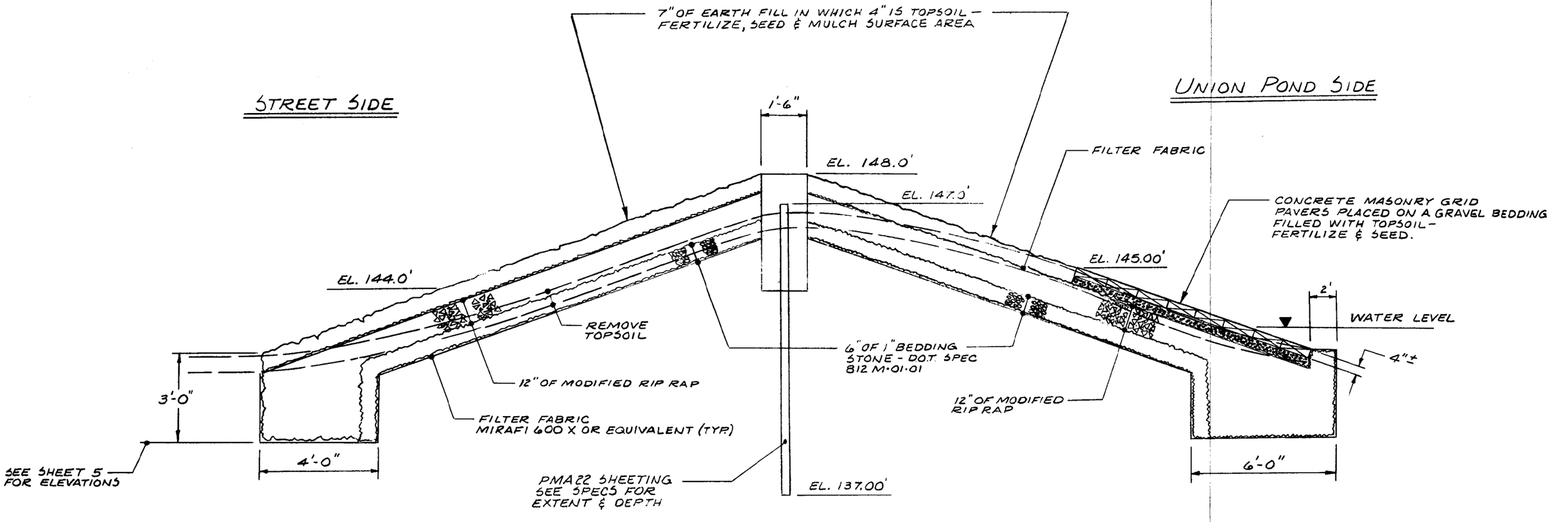
	CLARENCE WELTI ASSOCIATES CLARENCE W. WELTI P.E. GLASTONBURY, CONN. 06033	Sheet 6 of 8

PLATE C-1-7



TOWN OF MANCHESTER
CONNECTICUT
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

REVISED SURFACE TREATMENT TO EARTH DAM UNION POND DAM

9-15-88	N.S.		R.G.P.	

PLATE C-1-8

HOCKANUM RIVER AT UNION POND
MANCHESTER, CONNECTICUT

APPENDIX D

WATER QUALITY AND SEDIMENT EVALUATION

SECTION 107
NAVIGATION IMPROVEMENT PROJECT
RECONNAISSANCE PHASE INVESTIGATION

JULY 1989

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM MASSACHUSETTS 02254-9149

WATER QUALITY AND SEDIMENT EVALUATION
HOCKANUM RIVER AT UNION POND
MANCHESTER, CONNECTICUT

SECTION 107
NAVIGATION IMPROVEMENT PROJECT
RECONNAISSANCE PHASE INVESTIGATION

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WATER QUALITY AND SEDIMENT EVALUATION
UNION POND
MANCHESTER, CONNECTICUT

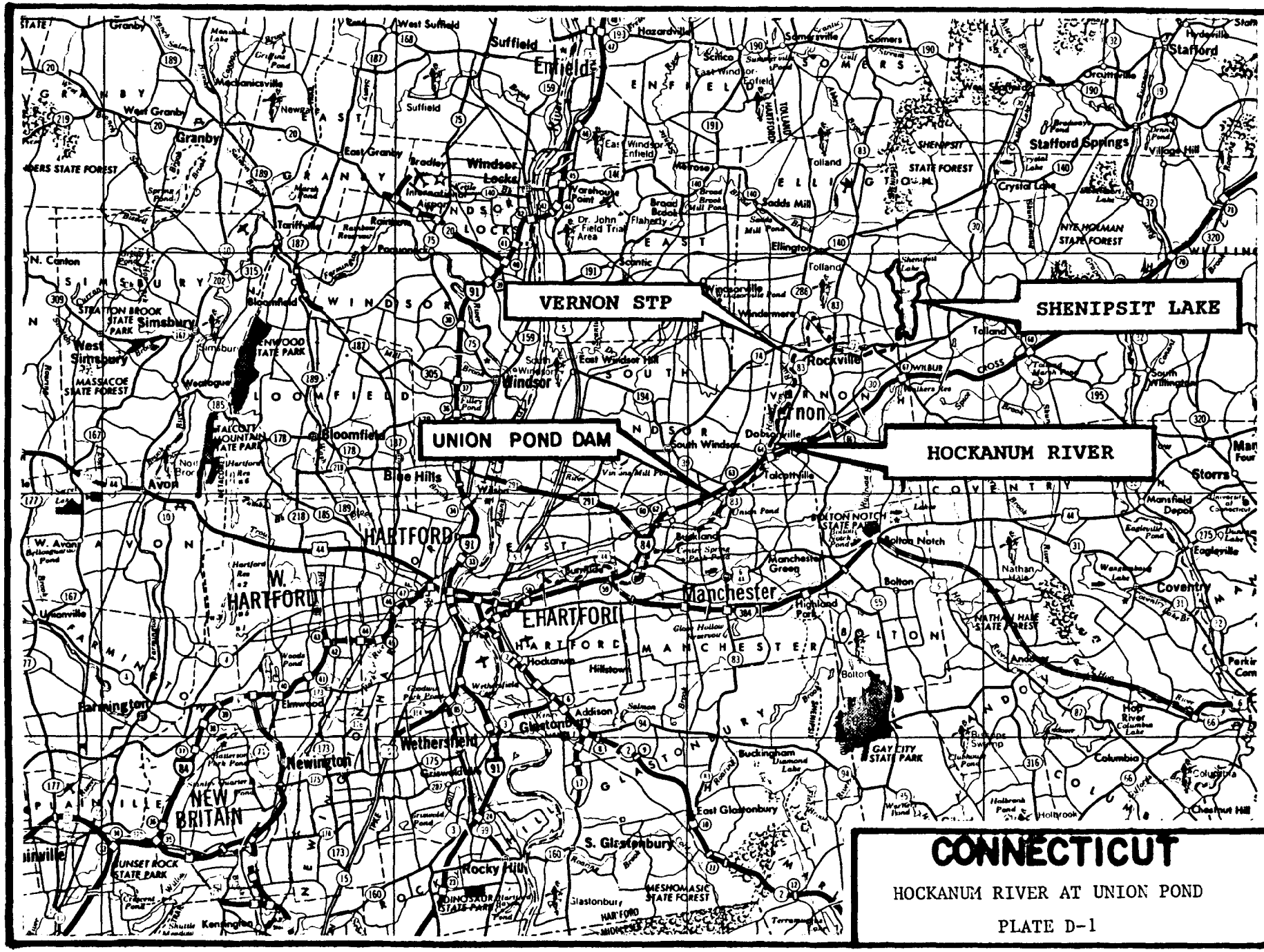
SECTION 107
SMALL NAVIGATION PROJECT
RECONNAISSANCE PHASE INVESTIGATION

1. GENERAL

a. Purpose. As part of a Reconnaissance Phase Investigation for a Section 107 Small Navigation Project at Union Pond in Manchester, Connecticut, the Corps of Engineers conducted an investigation into sediment and water quality. Since navigation would be recreational in nature, water quality could significantly affect recreational usage. As well, any proposed dredging must consider the quality of the sediments to be disposed. The intent of this report is to characterize the water quality of Union Pond in terms of meeting applicable criteria for recreational waters. Sediments were to be classified by relative degree of contamination as an aid in evaluating the options for disposal.

b. Background. The Hockanum River Basin, located in north-central Connecticut, is a tributary of the Connecticut River (see plate 1). The river originates in the Rockville section of the town of Vernon at the outlet of Shenipsit Lake, a water supply reservoir (drainage area of 16.4 square miles). The Hockanum River flows in a southwesterly direction to East Hartford where the 76.1-square mile watershed discharges into the Connecticut River. One significant impoundment exists along the main stream, Union Pond in Manchester (drainage area of 53.9 square miles), as well as several minor impoundments formed by industrial dams.

The Hockanum River has historically exhibited poor water quality. This led the former Connecticut Water Resources Commission to recommend secondary treatment for municipal sewage as early as 1953. The river is presently not up to its adopted standard of class B as prescribed by the 1973 Water Quality Standards, experiencing low dissolved oxygen levels, high nutrient levels and occasional coliform bacteria contamination. For this reason, the Hockanum River from the Vernon Sewage Treatment Plant (STP), drainage area of approximately 26 square miles, to the mouth has been designated a "water quality limited" segment pursuant to Section 303 of the 1972 Federal Pollution Control Act with Amendments (P.L. 92-500). The degree of treatment at the Vernon STP directly affects the water quality at the downstream Union Pond.


VERNON STP
SHENIPSIT LAKE
UNION POND DAM
HOCKANUM RIVER
CONNECTICUT
HOCKANUM RIVER AT UNION POND
PLATE D-1

c. Hockanum River Basin Water Use. The three prime uses of the Hockanum River are drinking water supply, irrigation, and dilution for wastewater assimilation. These are antagonistic uses because water withdrawn for water supply or irrigation reduces the quantity of flow available for wastewater assimilation and, thus, affects water quality in the river.

Water supply from Shenipsit Lake has a large impact on normal and low flows in the Hockanum River. The safe yield from Shenipsit Lake has been estimated by the Capitol Region Planning Agency to be 13 million gallons per day (MGD) or 20.1 cubic feet per second (cfs). For the year 2000, projected water demand is 6.55 MGD (10.1 cfs). Additionally, the Rockville Water and Aqueduct Company is authorized to export 3.0 MGD (4.7 cfs) out of the basin (only 1.8 MGD or 2.8 cfs can presently be used due to limited distribution capacity). Total demand from Shenipsit Lake is therefore 9.55 MGD (14.8 cfs), leaving 3.45 MGD (5.3 cfs) available for discharge to Hockanum River.

Irrigation needs for farming in the upper basin are greatest during dry periods when streamflow is critical. Irrigation needs have been estimated by the Connecticut Department of Environmental Planning (DEP) to be 3.0 MGD (4.7 cfs) during dry periods. Thus, approximately 0.45 MGD (0.7 cfs) are available for wastewater dilution, plus the flow available from the 9.1 square miles of drainage area between Shenipsit Lake and the Vernon STP. The contribution from the 9.1-square mile drainage area is estimated by the Connecticut DEP to be 1.1 MGD (1.7 cfs), yielding a net available flow of 1.55 MGD (2.4 cfs). If plans were made to eventually eliminate the need of the interbasin transfer, approximately 4.55 MGD (7.1 cfs) would be available for wastewater dilution at Vernon. Low flows at Union Pond are now in the order of approximately 5.0 MGD (7.7 cfs).

d. Point and Nonpoint Sources. Over the past 50 years, all manufacturing facilities (textile and metal finishing processes), between Union Pond and the Rockville section of the town of Vernon, which had used the Hockanum River as their primary source of effluent discharge, have ceased operation or established alternative methods for effluent discharge. Therefore, the only point source along the Hockanum River above Union Pond, according to the Town of Vernon Water Pollution Control Authority, is the Vernon sewage treatment plant. An assessment of the facility's design capacities and a future upgrading scheme is outlined in paragraph 1e.

A handful of industries along the river use Hockanum's water for cooling water purposes. Discharge of this water back into the river, at a minimally increased water temperature, will likely have a negligible effect on the river's water quality.

A significant nonpoint source within the basin is the nutrient loadings to Hockanum River from the Ellington Valley farms. These farms collectively drain into Marsh Brook, a tributary of the river with a drainage area of 5 square miles. The confluence of Marsh Brook with Hockanum River is located approximately 1.5 miles above the outfall from the Vernon STP.

Sampling performed by the State of Connecticut within the Marsh Brook watershed indicates the basin having a moderate nonpoint source pollution effect on the river. Mass loadings of nutrients were noticeably elevated.

e. Town of Vernon Sewage Treatment Plant. In 1953, the former Connecticut Water Resources Commission, based on a historical record of poor water quality in the Hockanum River, recommended that a secondary treatment plant be constructed at Vernon, Connecticut. This recommendation led to the construction of a trickling filter plant in Vernon in the 1960's. Continued poor water quality in the Upper Hockanum Basin led to the town of Vernon being ordered by the Connecticut Water Resources Commission to provide "adequate treatment".

With passage of the Clean Water Act in 1972 and the development of the 1973 Connecticut Water Quality Standards, the Hockanum River was designated a "water quality limited" stream. Modeling efforts were begun in the 1970's in order to create a waste load allocation for the Vernon sewage treatment plant. In 1975, an engineering report and plans and specifications for a new plant were approved by the Connecticut DEP.

The approved design was for a 6.4 MGD activated sludge/ powdered activated carbon (PAC) plant. The PAC system was provided primarily to remove color which originated from several textile plants in the area. This system removes 90 percent of influent biochemical oxygen demand (BOD) and suspended solids. It does not, however, remove significant levels of ammonia-nitrogen (NH3-N), which are a major factor in the water quality of Union Pond.

In order to attain a class B water quality standard in the upper river, it is necessary for the town of Vernon to remove NH3-N, thus providing the river with sufficient dissolved oxygen to support a diversified aquatic community. In 1980, DEP ordered Vernon to evaluate the ability of its sewage treatment plant to remove NH3-N and to determine what changes to the sewage treatment plant might be necessary to accomplish this removal. At this time, the upgrade project is in the design phase.

f. Classification. The Hockanum River, from the Vernon sewage treatment plant to Union Pond, is classified as a C-type surface water by the Connecticut DEP. Class C ratings are suitable for "certain fish and wildlife habitat, certain recreational activities, agricultural, industrial and other legitimate uses, including navigation; swimming may be precluded; one or more class B criteria or designated uses may be impaired; goal is class B unless a DEP or EPA approved use attainability analysis determines certain uses nonattainable." Although the river is classified as "C", its adopted standard is class B.

Technical requirements for class C waters include a dissolved oxygen (DO) which may be less than 5 mg/l, turbidity may exceed 25 JTU, and taste and color concentrations not to impair any usages specifically assigned to class B waters. Fecal coliform may exceed class B standards.

Class B inland surface waters are suitable for "recreational use, fish and wildlife habitat, agricultural and industrial supply, and other legitimate uses including navigation."

Technical requirements for class B waters include a minimum DO of 5 mg/l, turbidity not to exceed 25 JTU, fecal coliform not to exceed a log mean of 200 organisms/100 ml in any group of samples, nor shall 10 percent of the samples exceed 400 organisms/110 ml, and taste and odor concentrations not to impair any usages specifically assigned to this class.

Class B waters can generally be defined as those waters which provide a good habitat for aquatic life and are suitable for primary water contact. A major criterion for maintaining aquatic life is the maintenance of sufficient dissolved oxygen to support a diversified aquatic environment. Through the future addition of NH3-N removal at the town of Vernon STP, dissolved oxygen levels should be sufficient to support a diversified aquatic habitat. The basic criterion for primary water contact is that the water should have a low bacterial concentration and thereby limit the possibility of water users coming in contact with pathogenic organisms.

Disinfection of properly treated sewage by chlorination or ozonation is sufficient to reduce the bacterial concentration in a discharge such that it will not result in bacterial contamination. Future low bacterial counts and high dissolved oxygen levels at Union Pond would be directly related to a high level of treatment at the Vernon STP.

2. WATER QUALITY EVALUATION

a. General. According to the Connecticut DEP, low levels of dissolved oxygen and high coliform counts have occurred in the past along the Hockanum River. Additional data was gathered by the Corps for this study to examine levels of heavy metals and nutrients at Union Pond. This effort was undertaken to ascertain the pond's potential for use as a future water-based recreational facility.

Water quality samples were collected by the Corps of Engineers at three sites at Union Pond on 16 March 1989. Water quality sample locations were spread throughout Union Pond, with one sample situated in the flood plain area adjacent to the proposed park (site 1), another located at mid-pond at the upstream end of the pre-1901 pond (site 2) and the third taken at the left (looking downstream) spillway crest of Union Pond Dam (site 3). Locations of the sampling sites are shown on plate 2.

For each of the three water samples taken, metals analyses were performed along with concentration testing of alkalinity, residual chlorine, total kjedhal (TKN), nitrite/nitrate and ortho-phosphorus. An outline of metal constituents tested is provided in table 1 along with applicable Gold Book criteria. Concentration levels of the remaining constituents are listed in Appendix 1.

b. Criteria. There are no definite criteria against which the data collected at Union Pond can be compared to determine which parameters show a polluted condition. The criteria listed in the Environmental Protection Agency's (EPA) Gold Book are the latest available guidance for freshwater quality; however, they are not the last word on freshwater criteria for Union Pond. The EPA Gold Book criteria is based upon experiments with "sensitive aquatic organisms" using varied concentrations of the substance being tested which may not be totally representative of Union Pond.

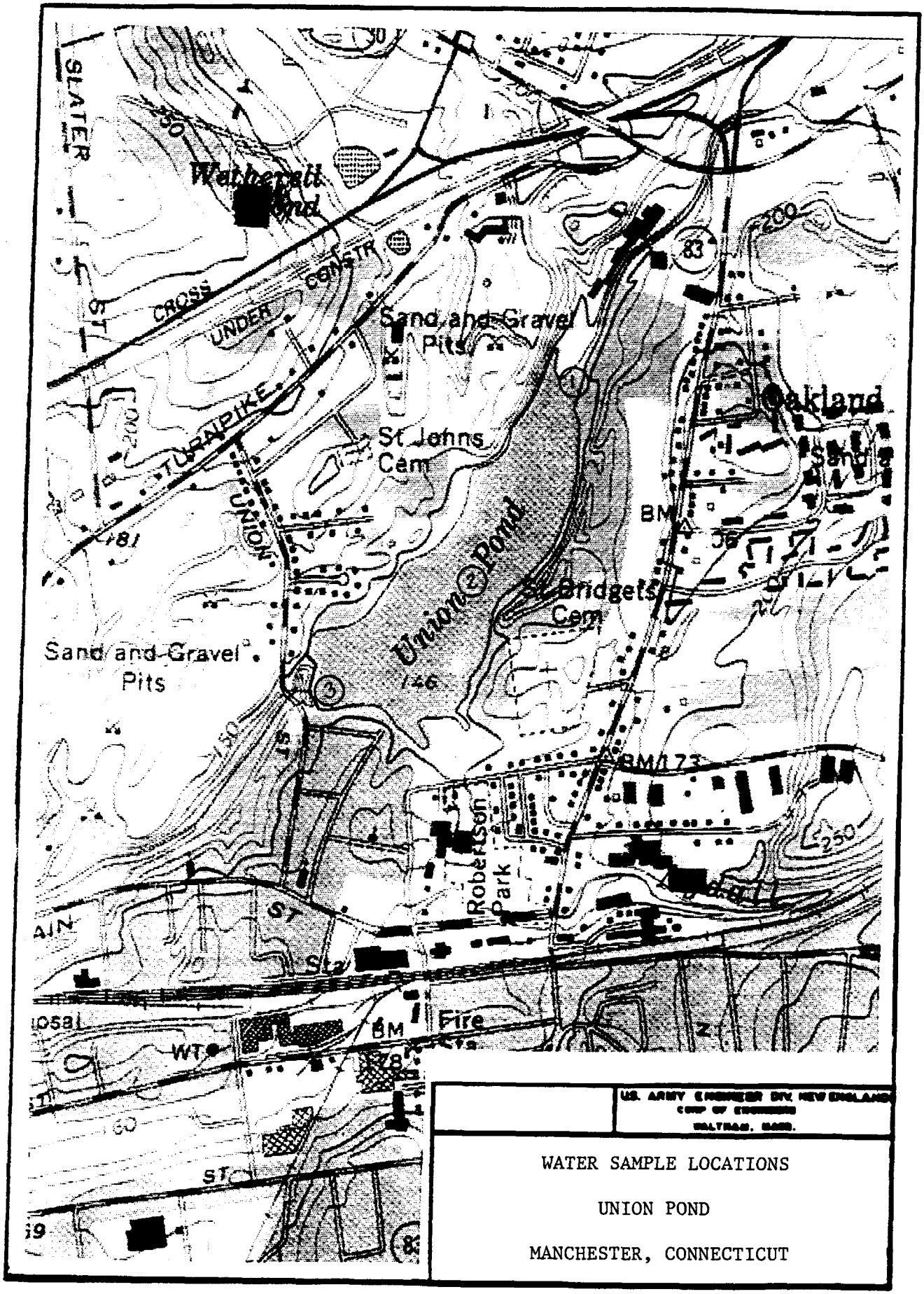

SLATER
Weatherell Rd
CONSTR
CROSS
UNDER
TURNPIKE
Sand and Gravel Pits
St Johns Cem
UNION
Union Pond
St Bridgets Cem
Oakland
BM
Sand and Gravel Pits
146
BM 173
Robertson Park
Fire
WT
ST
U.S. ARMY ENGINEER DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.
WATER SAMPLE LOCATIONS
UNION POND
MANCHESTER, CONNECTICUT

PLATE D-2

EPA Gold Book criteria is therefore used as a guideline; however, if metal levels are found in concentrations that are toxic to fish, according to Gold Book standards, and fish kills are not known to occur in the waterbody, then Gold Book criteria can be assumed not to be a good indicator of what organisms in the watercourse can actually tolerate. However, any finding of metal levels in excess of those which have been reported to cause fish flesh to be unsafe for human consumption are considered to be a problem regardless of whether any fish have actually been found with high levels in their flesh.

c. Analysis. Water quality data collected on 16 March 1989 indicate that the waters of Union Pond should be suitable for contact recreation provided bacterial contamination is eliminated by a properly functioning Vernon STP. All of the metals tested were found in concentrations clearly at or below Gold Book criteria levels except for cadmium and copper. These two metals are discussed in detail in the following paragraphs. Abundant nutrient levels were found, indicating algal growth potential. The addition of NH3-N removal at the Vernon STP should limit dissolved oxygen depletion. However, it is expected that sufficient nutrients for algal growth would persist.

(1) Cadmium

(a) General. Biologically, cadmium is a nonessential, nonbeneficial element recognized to be of high toxic potential. It is deposited and accumulated in various body tissues and is found in varying concentrations throughout all areas where man lives. Within the past few decades, industrial production and the use of cadmium have increased, with an incidental accompanying increase in acute cases of cadmiosis. Cadmium, by itself or in conjunction with other agents, may cause a variety of human ailments including tumors, kidney disorders, high blood pressure, arteriosclerosis and cancer.

Cadmium is used as a metallurgical alloy, in electroplating ceramics, pigmentation, and photography. Cadmium salts have been used as insecticides and antihelminthics.

Table 1 contains a summary of cadmium criteria and concentrations found at Union Pond.

TABLE 1

UNION POND

WATER QUALITY SAMPLING EVALUATION

Parameter	Concentration (ppm) Station 1	Station 2	Station 3	Limiting* Value (ppm)
Arsenic	0.001	< 0.001	0.001	0.36
Cadmium	< 0.003	< 0.003	< 0.003	0.0024
Chromium	0.009	0.009	0.010	1.2
Copper	0.025	0.023	0.025	0.012
Iron	0.284	0.324	0.331	1.0
Lead	< 0.001	0.003	0.002	0.047
Manganese	0.092	0.107	0.111	0.10
Mercury	< 0.0002	< 0.0002	< 0.0002	0.0024
Nickel	< 0.010	< 0.010	< 0.010	0.9
Zinc	0.04	0.034	0.030	0.081
Alkalinity	58	54	53	> 20

* Based on EPA's Gold Book 1-hour average concentration. (Freshwater aquatic organisms and their uses should not be affected unacceptably.)

(b) Water Quality Criteria. The Gold Book reports that, "except possibly where a locally important species is very sensitive , freshwater aquatic organisms and their uses should not be affected unacceptably if the 4-day average concentration (ug/l) of cadmium does not exceed the numerical value given by exp(0.7852 [ln (hardness)] - 3.490) more than once every three years on the average and if the one-hour average concentration does not exceed the numerical value given by exp(1.128 [ln (hardness)] - 3.828) more than once every three years on the average."

Using the average hardness at Union Pond to be 65 mg/l as CaCO3, the acute and chronic cadmium criteria would be 2.4 and 0.8 ug/l, respectively. The Gold Book states that the water quality criterion to protect human health from the toxic effects of cadmium in water is 10 ug/l. No separate criterion is given for protection for human health from the consumption of contaminated aquatic organisms only.

(c) Levels at Union Pond. Cadmium concentrations at all three sites were less than the 3 ug/l detection limit for the analytical procedures used.

(d) Conclusion. Cadmium does not appear to be a problem at Union Pond. The levels found were less than the 10 ug/l necessary to protect human health from toxic effects. Although the 3 ug/l detection limit was higher than the Gold Book's standard of 2.4 ug/l necessary to protect aquatic life, the detection limit is close enough to this standard to make it reasonable to assume that cadmium levels are not a threat to freshwater organisms.

(2) Copper

(a) General. Copper salts occur in natural surface waters only in trace amounts up to approximately 0.05 mg/l, so that their presence is generally the result of pollution, attributable to corrosive action of the water on copper and brass tubing, industrial effluents, or frequently to the use of copper compounds for the control of undesirable plankton organisms. Copper is an essential trace element for the propagation of plants and is required in animal metabolism.

Uses for copper include electrical products, coins, and metal plating. Copper frequently is alloyed with other metals to form various brasses and bronzes. Oxides and sulfates of copper are used for pesticides, algicides and fungicides. Copper is commonly incorporated into wood preservatives to inhibit growth of algae and invertebrate organisms.

Table 1 contains a summary of copper criteria and concentrations found at Union Pond.

(b) Water Quality Criteria. The Gold Book reports that except possibly where a locally important species is very sensitive, freshwater aquatic organisms and their uses should not be affected unacceptably if the 4-day average concentration (ug/l) of copper does not exceed the numerical value given by exp(0.8545 [ln (hardness)] - 1.465) more than once every three years on average and the 1-hour average concentration should not exceed the numerical value given by exp(0.9422 [ln (hardness)] - 1.464) more than once every three years on average.

Using the average hardness at Union Pond of 65 mg/l as CaCO3, the acute and chronic copper criteria would be 11.8 and 8.3 ug/l, respectively. To protect human health, the copper criterion for ambient water is 1.0 mg/l based on organoleptic data.

(c) Levels at Union Pond. The results of copper measurements at Union Pond were 0.025 ppm at site 1, 0.023 at site 2, and 0.025 at site 3. The mean copper measurement was 0.024 ppm.

(d) Conclusion. Although not a threat to swimmers or consumers of fish caught at Union Pond, copper levels appear to be high enough to interfere with growth, reproduction and survival of fish and other organisms at the pond.

Copper levels in the water samples at Union Pond varied minimally from the pond's point of inflow to the spillway at its exit. Based upon the Gold Book's standard for acceptable freshwater organism habitat of 11.8 ug/l, the mean level of copper measured (24.0 ug/l) violates this criterion, although remaining below the 1000 ug/l criterion for protection of human health.

d. Discussion. The waters of Union Pond should be suitable for contact recreation provided bacterial contamination is eliminated by a properly functioning Vernon STP. Elevated levels of copper, although remaining higher than the standards outlined for acceptable freshwater organism habitat, do not appear to be a threat to human health. All other metal concentrations were clearly at or below Gold Book criteria levels.

The sampling data indicates that the waters are generally soft, having an approximate hardness of 65 mg/l as CaCO3.

With a normal capacity of 515 acre-feet, hydraulic residence time at Union Pond during low flow can be significantly over a week. Under these flushing conditions, along with abundant nutrient loadings, algae blooms would be expected. While not likely to be a health problem, these could make the water unappealing for recreation.

It has been reported in the past that low levels of dissolved oxygen and high coliform counts have been experienced at the pond. Through the proposed addition of NH3-N removal at the town of Vernon's STP, dissolved oxygen levels within the river should be at levels sufficient enough to support a diversified aquatic community. Bacterial contamination is directly related to the degree of treatment performed at the Vernon STP. A program of coliform sampling should be a part of any future contact recreation program.

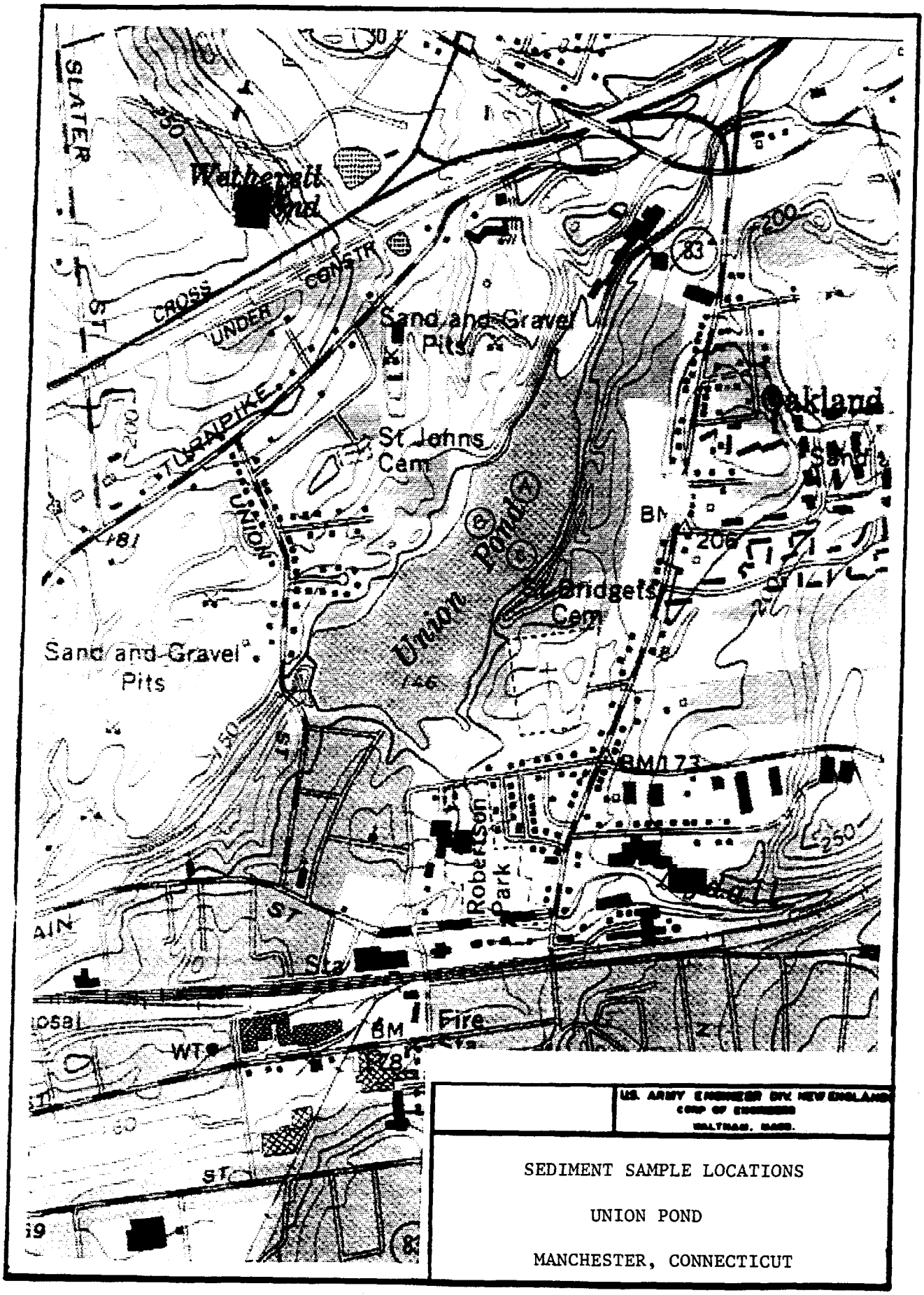
Dredging at Union Pond, although slightly increasing detention time, would lower sediment oxygen demand and nutrient release, thereby improving water quality. With dredging though, turbidity levels would be temporarily increased.

3. SEDIMENT QUALITY EVALUATION

a. General. Sediment samples were collected by the Corps of Engineers at three sites at Union Pond on 16 March 1989. Sediment sample locations were confined mainly to the northwest area of Union Pond, with one sample situated in the flood plain area adjacent to the proposed park (site A) and the other two samples located at the upstream end of the pre-1901 pond (sites B and C). Locations of the sampling sites are shown on plate 3.

A plastic corer was used to obtain the three samples from the pond. Physical testing for all samples of sediment was performed and total or bulk sediment chemical testing of those samples containing sufficient fine material was also completed. Physical analyses included grain size distribution and volatile solids determination; bulk sediment chemical testing included metals, petroleum hydrocarbons and polychlorinated biphenyl (PCB) analyses.

b. Criteria. No specific criteria exists for sediment analysis and none are likely to be developed because the behavior of pollutants in sediments is so greatly affected by the chemical composition and grain size of the sediments. Freshwater quality criteria cannot be directly translated to sediment quality criteria, due to the complex interchange of compounds between the sediments and overlying waters. Temperature, pH, dissolved oxygen, hardness, particle size and the organic content of the sediments, and especially the form



U.S. ARMY ENGINEER DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

SEDIMENT SAMPLE LOCATIONS

UNION POND

MANCHESTER, CONNECTICUT

PLATE D-3

of the compound in the sediments determine the equilibrium concentration in the overlying waters. Furthermore, dissolution is not the only pathway by which materials in the sediment can affect aquatic life. Polychlorinated biphenyls (PCB's), for example, can enter the food chain by adsorbing to plant material and then being consumed by herbivores.

Bioassays are the most effective method for determining if sediments are polluted, but are expensive and time-consuming. In trying to fill the void created by a lack of specific criteria, the "Guidelines for the Pollutional Classification of Great Lakes Harbor Sediments" is often used.

These guidelines were developed in April 1977 by Region V of the U.S. Environmental Protection Agency under pressure for the need to make immediate decisions regarding the disposal of dredged material. Criteria used in this classification is shown in table 2. These guidelines are described as not having "been adequately related to impact of the sediments of the lake and are considered interim until more scientifically sound ones are developed".

Less than two dozen substances, mostly metals, are included in these guidelines. Where these standards are most useful is in determining what are likely to be unpolluted sediments. If levels of a substance in a given sediment are less than the "unpolluted" levels given in the guidelines, then the sediment can be deemed "unpolluted". The area in which these guidelines are least accurate is in the determination of what levels are a problem.

Also, there are two types of data from other surveys that can be used to compare sediments found at Union Pond. One type is a global or background soil comparison referred to as the Sediment Pollution Index (SPI). The SPI relates sediment conditions encountered in a watercourse with sediment data form other areas. It uses the Clarke Number which reflects the average natural occurrence of metals in the earth's crust, thereby providing a basis for estimating the background level of metals in the sediments. A listing of Clarke Numbers is shown in table 3.

The Sediment Pollution Index is of limited usefulness as it does not indicate at which levels the metals are harmful in the soil or what forms of the particular metals are found. Also, the index does not take into account the variability which exists with upstream geologic conditions, sediment particle sizes or the amount of organics.

TABLE 2

GREAT LAKES SEDIMENT RATING CRITERIA
(ppm, dry weight)

Constituent	Nonpolluted	Moderately Polluted	Heavily Polluted
Ammonia	< 75	75-200	> 200
Arsenic	< 3	3-8	> 8
Cadmium	*	*	> 6
Chromium	< 25	25-75	> 75
Copper	< 25	25-50	> 50
Iron	< 17,000	17,000-25,000	> 25,000
Lead	< 40	40-60	> 60
Manganese	< 300	300-500	> 500
Mercury	< *	*	≥ 1
Nickel	< 20	20-50	> 50
Petroleum Hydrocarbons	< 1,000	1,000-2,000	> 2,000
Phosphorus	< 420	420-650	> 650
Polychlorinated Biphenyls (PCB)	< 1	*	> 10
TKN	< 1,000	1,000-2,000	> 2,000
Zinc	< 90	90-200	> 200

* No lower limit defined.

Source: EPA, "Guidelines for the Pollutional Classification of Great lakes Harbor Sediments", U.S. Environmental Agency, Region V, Chicago, Illinois, April 1977.

TABLE 3

AVERAGE ABUNDANCE OF METALS IN EARTH'S CRUST "CLARKE NUMBER"

Metal	Clarke Number Earth's Crust (ppm)
Ag	0.07
Al	82,000
As	1.8
Ba	425
Cd	0.1
Cr	100
Cu	55
Fe	56,000
Hg	0.08
Mn	950
Ni	75
Pb	12.5
Se	0.05
Zn	70

Source: Upper Mystic Lake Watershed Urban Runoff Project, Massachusetts DEQE, October 1982.

The older the sediments and the more reactive the chemical environment, the higher the rates of leachate of mineral metals from the sediments, and the higher the computed SPI value. Therefore, sediments having higher metal concentrations than the Clarke Number may be polluted. Conversely, sediments composed mainly of inorganic matter (80 to 95 percent) are expected to contain metal concentrations less than or equal to the Clarke Number.

A rule of thumb used in evaluating the pollutional content of sediment is to assume that for a sediment to be classified as clean, the ratio of trace metal concentrations to the Clarke Number for that particular metal should be less than two, while for more common metals, the ratio should rarely exceed one. Data for a site with a number of different metal results may also be analyzed by summing all the ratios and dividing by the number of metals evaluated, resulting in a cumulative ratio.

For example, a report on the Upper Mystic Lake watershed completed by the Massachusetts Department of Environmental Quality Engineering in 1982, a cumulative ratio of 10 was chosen as an index of pollution. This point was determined to be the breakoff point between polluted and nonpolluted lakes based on the sampling of 15 other State of Massachusetts lakes.

The other type of comparison is a pollutional characterization of sediment data collected from New England freshwater rivers. Locations with at least partial listings of sediment data include the Oxoboxo River in Connecticut, the Aroostook River in Maine, and the Winnepesaukee River in New Hampshire. These locations could be characterized as relatively unpolluted with the exception of parts of the Oxoboxo River. Table 4 outlines average sediment concentrations for various parameters for these rivers.

c. Analysis. For each of the three sediment samples taken, two bulk sediment chemical tests were applied. One bulk sediment chemical test was performed on the upper 0.25 foot of the core sample, with the other test initiated on the lower 0.25+ foot of the sample. Sediment cores were taken to a depth of 1.8 to 2.3 feet. The rationale in undertaking two bulk sediment chemical tests at different locations within a sample is that a somewhat rough, time versus constituent applied comparison can be made.

TABLE 4

NEW ENGLAND FRESHWATER SEDIMENT COMPARISON, ppm*

Parameter	Union Pond	Oxoboxo River	Aroostook River	Winnepesaukee River
Aluminum	13,330	13,000	-	6,000
Arsenic	6.7	9	7	2.3
Cadmium	4	15	-	ND
Chromium	668	62	-	12
Copper	211	274	13	14
Lead	299	180	67	90
Manganese	296	180	-	180
Mercury	1.0	0.39	-	0.11

ND - Non-dectable

* Concentrations listed for the various rivers are average values.

The three methods of comparison to be performed on the Union Pond bulk sediment chemical testing results are:

Great Lakes Sediment Rating Index
Sediment Pollution Index
New England freshwater sediment comparison

d. Samples. Physical testing at all locations showed the material to be predominantly sandy organic silt. All samples exhibited an increase in volatile solids as sample depth increased. Results of the physical testing are shown in Appendix 1.

Listed below are conclusions drawn from results of the bulk sediment analyses on the three samples. Conclusions were drawn from joint comparison between the Great Lake Sediment Rating Index (GLSRI) and the Sediment Pollution Index (SPI). Each sample had two sediment analyses performed on them, with one test on the upper portion of the sample and the other test conducted on its base. Results of the chemical testing are also contained in Appendix 1.

Sample A: Upper 0.25 foot of the core sample. According to the GLSRI and the SPI, the Union Pond levels could be classified as nonpolluted with the exception of lead which is classified as moderately polluted.

Sample A: Lower 0.30 foot of 2.3 feet deep core sample. Based on the analysis of parameter levels listed in the GLSRI and the SPI, levels at this depth could be classified as heavily polluted with arsenic, cadmium, chromium, copper, mercury, lead, zinc and petroleum hydrocarbons. In comparing the sediment of this sample at Union Pond with other New England freshwater sediment levels, it can be noted that this sample's levels for chromium, copper, lead and mercury are higher than those values associated with the polluted Oxoboxo River in Connecticut.

Sample B: Upper 0.25 foot of the core sample. Using the GLSRI and the SPI, levels could be classified as heavily polluted with high parameter levels of chromium, copper, lead and zinc; and moderately polluted with cadmium and petroleum hydrocarbons. Levels of aluminum, chromium, lead, manganese and mercury are at or above the average findings for the polluted Oxoboxo River.

Sample B: Lower 0.25 foot of 1.83 feet deep core sample. According the GLSRI and the SPI, levels at this depth could be classified as heavily polluted with high concentrations of chromium, copper, mercury, lead and zinc.

Moderate levels of arsenic were found. In comparing the sediment of this sample at Union Pond with other New England freshwater sediment levels, it can be noted that this sample's levels for chromium, lead, manganese and mercury are higher than those values associated with the polluted Oxoboxo River in Connecticut.

Sample C: Upper 0.25 foot of the core sample. Based on the analysis of parameter levels listed in the GLSRI and the SPI, Union Pond levels could be classified as moderately polluted for arsenic and cadmium and heavily polluted with concentrations of chromium, copper, lead, zinc and petroleum hydrocarbons. Levels of chromium, lead, manganese and mercury are above the average findings for the polluted Oxoboxo River.

Sample C: Lower 0.25 foot of 1.83 feet deep core sample. Using the GLSRI and the SPI, parameter levels could be classified as heavily polluted with chromium, copper, lead, zinc and petroleum hydrocarbons. Moderate pollution levels of arsenic and cadmium were determined. In comparing the sediment of this sample at Union Pond with other New England freshwater sediment levels, it can be noted that this sample's levels for chromium, copper, lead, manganese and mercury are higher than those values associated with the polluted Oxoboxo River in Connecticut.

e. Discussion. Based on the rough evaluations used in this report, the sediments of Union Pond are moderately to heavily polluted by elevated levels of arsenic, cadmium, chromium, copper, lead, mercury, zinc and petroleum hydrocarbons. Therefore, a site approved for contaminated sediments may be necessary for disposal of the dredged material.

Pollutant concentrations, for the most part, increased as the depth of the sample increased, indicating that the worst contamination occurred in the past, and that water quality conditions are improving.

4. CONCLUSION

The water quality of Union Pond can be classified as generally within class C limits. However, the water does not meet its adopted class B standard due to its recurring low dissolved oxygen levels and high coliform counts. Metal analysis revealed no threat to human health. Water quality conditions have improved over the years due to the curtailment of point source discharges and the past upgrading of the town of Vernon sewage treatment plant along the upstream portion of the Hockanum River. Until nitrogen removal is added to the Vernon STP, it is anticipated that the periodic low dissolved oxygen levels will continue, especially during low flows. Bacterial contamination and suitability for contact recreation will continue to be a function of the degree of treatment applied at Vernon. Periodic monitoring of coliform bacteria should be a part of any future contact recreation program. Nutrient levels appear high indicating that algal growth might be expected, thus affecting water aesthetics for recreation.

Sediment analysis at the proposed dredging areas have indicated that the material is a generally sandy organic silt in nature containing moderate to heavy amounts of contaminants which may lead to problems with metal releases during the dredging operation. Some of the sediments contain high levels of petroleum hydrocarbons; however, PCB's were found only in trace concentrations. A site approved for contaminated sediments may be necessary for disposal of dredged material from Union Pond.

The bulk sediment testing performed is not an accurate test to determine what will happen when the dredged sediments are placed on upland areas. Moderate levels of organic matter may cause anaerobic conditions to develop if placed in an area where there is moisture and may result in a reducing action which would cause the metals to revert to their soluble form and be available to be transmitted through the soil to the groundwater.

Further testing, including bioassay and elutriate, should be performed if this project enters the design phase to address these potential problems.

APPENDIX D-1

WATER AND SEDIMENT QUALITY
SAMPLING DATA

TABLE D-5
HOCKANUM RIVER AT UNION POND
MANCHESTER, CONNECTICUT

WATER QUALITY SAMPLES

(All Values in Parts per Million)

Parameter	Site #1	Site #2	Site #3
Aluminum	0.152	0.177	0.133
Arsenic	0.001	< 0.001	0.001
Calcium	18.9	19.0	18.8
Cadmium	< 0.003	< 0.003	< 0.003
Chromium	0.009	0.009	0.010
Copper	0.025	0.023	0.025
Iron	0.284	0.324	0.331
Lead	< 0.001	0.003	0.002
Magnesium	4.17	4.28	4.31
Manganese	0.092	0.107	0.111
Mercury	< 0.0002	< 0.0002	< 0.0002
Nickel	< 0.010	< 0.010	< 0.010
Zinc	0.04	0.034	0.03
Alkalinity	58	54	53
Residual Chlorine	< 0.1	< 0.1	< 0.1
TKN	5.2	3.8	3.0
Nitrite	0.02	0.02	0.01
Nitrate	2.04	1.95	1.87
Ortho-Phosphorus	0.46	0.33	0.30

Samples taken March 16, 1989

TABLE D-6
HOCKANUM RIVER AT UNION POND
MANCHESTER, CONNECTICUT

POND SEDIMENT SAMPLE TEST RESULTS
(All Values in Parts per Million)

SAMPLE SITE A

Sample Depth (Feet)	0.0-2.02	0.0-0.7	0.7-1.67	0.0-0.25	2.0-2.3
Visual Classification		Medium brown sandy organic Silt (OL) with weeds & wood fibers	Dark brown sandy organic Silt (OL) with brn sand and silt to 2.02'		
Grain Size Curve					
% Fines		46	58		
Median		0.0800	0.0500		
Q1		0.1800	0.1500		
Q3		0.0625	0.0216		
Normal/Bimodal		N	N		
Liquid Limit		---	---		
Plastic Limit		Non-	Non-		
Plastic Index		Plastic	Plastic		
Specific Gravity		2.66	2.42		
Wet Unit Weight pcf	85.53				
Dry Unit Weight pcf	46.82				
Percent Solids				56.0	40.6
% Volatile Solids EPA				7.33	20.11
% Volatile Solids NED				6.17	16.74
PPM Arsenic				0.8	16.5
PPM Aluminum				5,300	12,200
PPM Cadmium				< 8	10
PPM Calcium				1,300	1,200
PPM Chromium				57	1,900
PPM Copper				39	398
PPM Iron				8,800	13,200
PPM Lead				53	615
PPM Magnesium				1,600	2,300
PPM Manganese				265	114
PPM Mercury				0.158	1.35
PPM Nickel				8	40
PPM Zinc				101	534
% Total Organic Carbon				0.78	2.00
PPM Petroleum Hydrocarb.				262	3,760
PPB PCBs				200	<10

TABLE D-6 (Cont.)
HOCKANUM RIVER AT UNION POND
MANCHESTER, CONNECTICUT

POND SEDIMENT SAMPLE TEST RESULTS
(All Values in Parts per Million)

SAMPLE SITE B

Sample Depth (Feet)	0.0-1.75	0.0-0.7	1.1-1.75	0.0-0.25	1.58-1.83
Visual Classification		Medium brown organic Silt (OH) with weeds & wood fibers & sand	Dark brown organic Silt (OH) with sand & wood fibers & weeds		
Grain Size Curve					
% Fines		80	70		
Median		0.0200	0.0700		
Q1		0.3500	0.1000		
Q3		0.0160	0.0247		
Normal/Bimodal		N	N		
Liquid Limit			132		
Plastic Limit			72		
Plastic Index			60		
Specific Gravity		2.41	2.46		
Wet Unit Weight pcf	83.66				
Dry Unit Weight pcf	36.83				
Percent Solids				45.3	28.3
% Volatile Solids EPA				13.4	29.8
% Volatile Solids NED				11.7	27.4
PPM Arsenic				1.9	7.4
PPM Aluminum				13,000	8,400
PPM Cadmium				4	<1
PPM Calcium				2,400	1,800
PPM Chromium				239	184
PPM Copper				223	90
PPM Iron				13,500	8,500
PPM Lead				189	311
PPM Magnesium				3,100	2,200
PPM Manganese				338	462
PPM Mercury				0.604	2.47
PPM Nickel				20	12
PPM Zinc				434	658
% Total Organic Carbon				1.00	2.50
PPM Petroleum Hydrocarb.				1,110	260
PPB PCBs				820	< 10

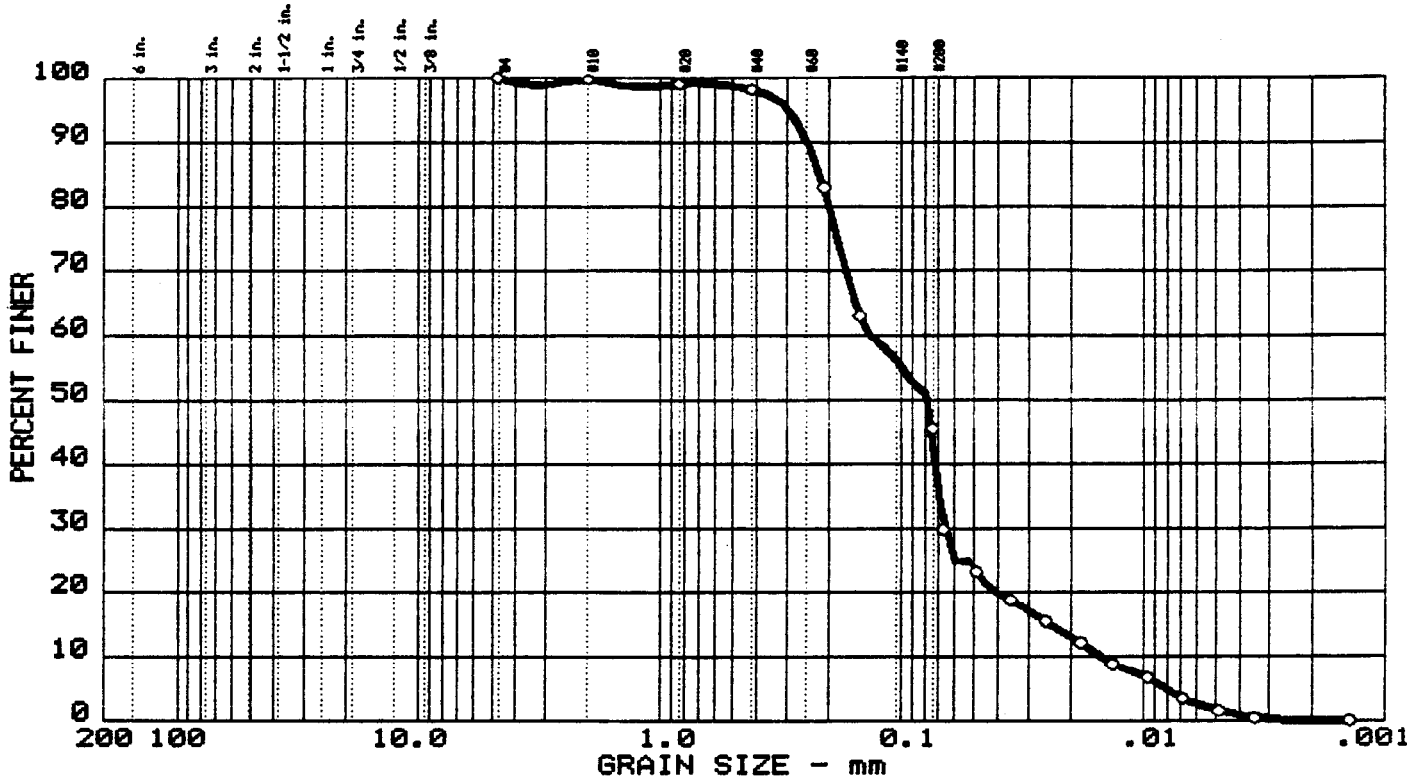
TABLE D-6 (Cont.)
HOCKANUM RIVER AT UNION POND
MANCHESTER, CONNECTICUT

POND SEDIMENT SAMPLE TEST RESULTS
(All Values in Parts per Million)

SAMPLE SITE C

Sample Depth (Feet)	0.0-1.6	0.0-0.7	0.7-1.61	0.0-0.25	1.58-1.83
Visual Classification		Medium brown sandy organic Silt (OL) with weeds & few wood fibers	Dark brown sandy organic Silt (OL) with weeds & few wood fibers		
Grain Size Curve					
% Fines		68	68		
Median		0.0600	0.0600		
Q1		0.0800	0.1100		
Q3		0.0214	0.0191		
Normal/Bimodal		N	N		
Liquid Limit		---	---		
Plastic Limit		Non-	Non-		
Plastic Index		Plastic	Plastic		
Specific Gravity		2.56			
Wet Unit Weight pcf	93.02				
Dry Unit Weight pcf	35.59				
Percent Solids				39.8	39.9
% Volatile Solids EPA				14.4	16.4
% Volatile Solids NED				12.6	14.9
PPM Arsenic				5.2	7.8
PPM Aluminum				10,000	12,800
PPM Cadmium				3	5
PPM Calcium				2,700	3,200
PPM Chromium				331	1,300
PPM Copper				191	324
PPM Iron				14,900	15,700
PPM Lead				402	324
PPM Magnesium				3,400	2,700
PPM Manganese				373	224
PPM Mercury				0.478	0.689
PPM Nickel				32	16
PPM Zinc				419	1,500
% Total Organic Carbon				1.50	3.00
PPM Petroleum Hydrocarb.				2,300	18,000
PPB PCBs				1,150	550

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
○	1	0.0	0.0	54.5	43.8	1.7

	LL	PI	D_{75}	D_{60}	D_{50}	D_{30}	D_{25}	D_{10}	C_c	C_u
○	NP	NP	0.18	0.13	0.08	0.067	0.0625	0.0150	2.24	8.9

MATERIAL DESCRIPTION	USCS	AASHTO
○ SAMPLE NO. A1-T2 (TOP OF TUBE)	OL	

Project No.: 100-495-2
Project: UNION POND , CONN.
○ Location: TUBE A-T2 , DEPTH: 0.0 FT. TO 0.7 FT.

Date: 5-1-89

GRAIN SIZE DISTRIBUTION TEST REPORT
CORPS OF ENGINEERS - NEW ENGLAND

Remarks:
SANDY ORGANIC SILT
DRY DENSITY: 46.82 PCF
VOLATILES EPA: 7.33%
VOLATILES NED: 6.17%

Fig. No. 1

SITE A - UPPER FRACTION

GRAIN SIZE DISTRIBUTION TEST DATA Test No.: 1

Date: 5-1-89
Project No.: 100-495-2 SITE A - UPPER FRACTION
Project: UNION POND , CONN.

Sample Data

Location of Sample: TUBE A-T2 , DEPTH: 0.0 FT. TO 0.7 FT.
Sample Description: SAMPLE NO. A1-T2 (TOP OF TUBE)
USCS Class: OL Liquid limit: NP
AASHTO Class: Plasticity index: NP

Notes

Remarks: SANDY ORGANIC SILT DRY DENSITY: 46.82 PCF
VOLATILES EPA: 7.33% VOLATILES NED: 6.17%
Fig. No.: 1

Mechanical Analysis Data

	Initial
Dry sample and tare=	71.90
Tare =	0.00
Dry sample weight =	71.90

Sieve tare method

Sieve	Weight retained	Sieve tare	Percent finer
# 4	0.00	0.00	100.0
# 10	0.20	0.00	99.7
# 20	0.50	0.00	99.0
# 40	0.70	0.00	98.1
# 70	10.90	0.00	82.9
# 100	14.40	0.00	62.9
# 200	12.50	0.00	45.5

Hydrometer Analysis Data

Separation sieve is number 10
Percent -# 10 based on complete sample= 99.7
Weight of hydrometer sample: 71.9
Calculated biased weight= 72.1
Table of composite correction values:

Temp, deg C:	17.0	18.0	19.0	20.0	21.0
Comp. corr:	- 4.0	- 3.7	- 3.4	- 3.1	- 2.9

Meniscus correction only= 0.5
Specific gravity of solids= 2.66
Specific gravity correction factor= 0.998
Hydrometer type: 151H Effective depth L= 16.294964 - 0.2645 x Rm

SITE A - UPPER FRACTION

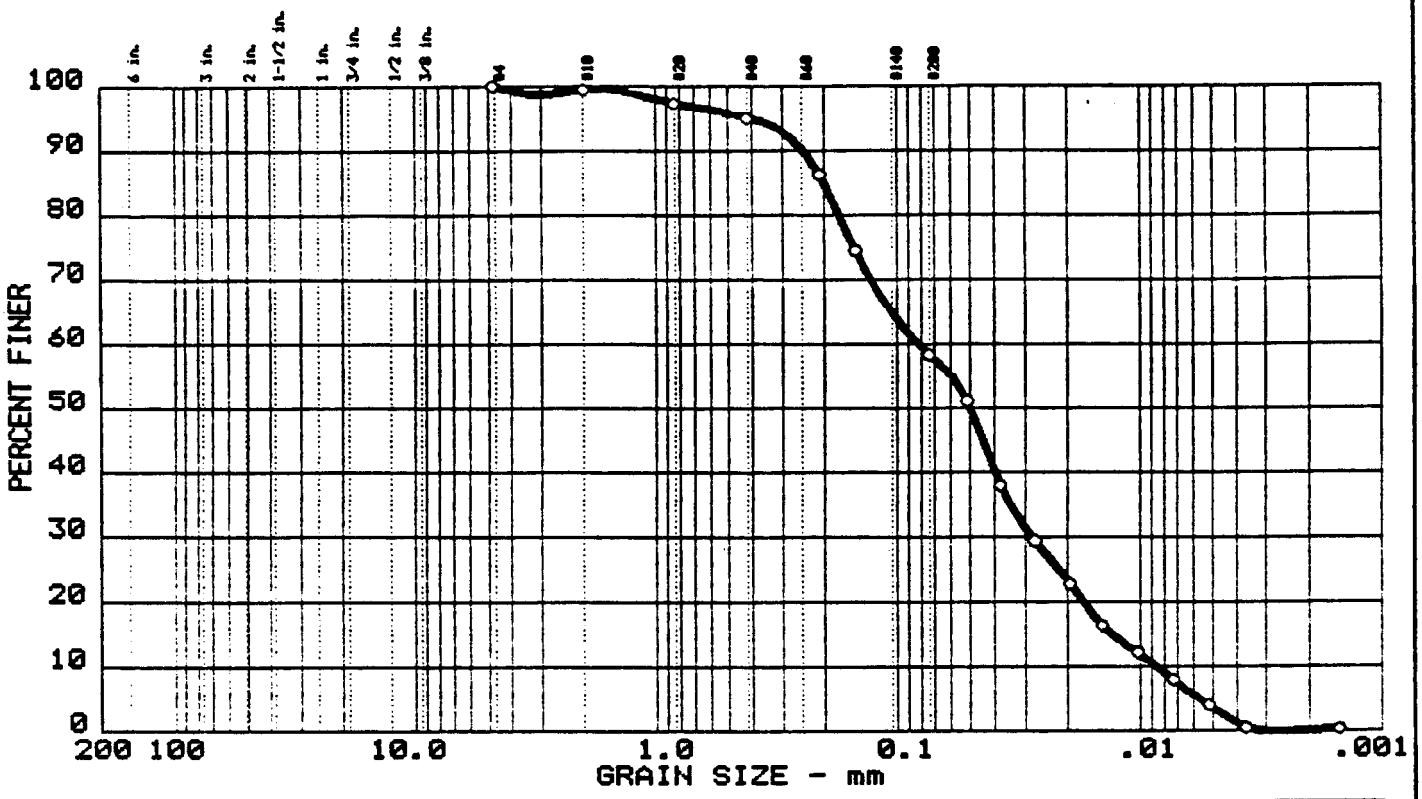
Elapsed time, min	Temp, deg C	Actual reading	Corrected reading	K	Rm	Eff. depth	Diameter mm	Percent finer
0.5	18.4	1.0170	1.0134	0.0139	17.5	11.7	0.0670	29.8
1.0	18.4	1.0140	1.0104	0.0139	14.5	12.5	0.0490	23.2
2.0	18.4	1.0120	1.0084	0.0139	12.5	13.0	0.0354	18.7
4.0	18.5	1.0105	1.0070	0.0139	11.0	13.4	0.0254	15.4
8.0	18.5	1.0090	1.0055	0.0139	9.5	13.8	0.0182	12.1
15.0	18.6	1.0075	1.0040	0.0138	8.0	14.2	0.0135	8.8
30.0	18.7	1.0065	1.0030	0.0138	7.0	14.4	0.0096	6.7
60.0	18.9	1.0050	1.0016	0.0138	5.5	14.8	0.0069	3.5
120.0	19.4	1.0040	1.0007	0.0137	4.5	15.1	0.0049	1.6
240.0	19.4	1.0035	1.0002	0.0137	4.0	15.2	0.0035	0.5
1440.0	20.6	1.0030	1.0000	0.0135	3.5	15.4	0.0014	0.0

Fractional Components

% + 3 in. = 0.0 % GRAVEL = 0.0 % SAND = 54.5
% SILT = 43.8 % CLAY = 1.7

D75= 0.18 D60= 0.134 D50= 0.078
D30= 0.0670 D25= 0.06248 D10= 0.01499
Cc = 2.2400 Cu = 8.9279

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
o	2	0.0	0.0	41.6	54.8	3.6

	LL	PI	D_{75}	D_{60}	D_{50}	D_{30}	D_{25}	D_{10}	C_c	C_u
o	NP	NP	0.15	0.08	0.05	0.028	0.0216	0.0086	1.11	9.5

	MATERIAL DESCRIPTION	USCS	AASHTO
o	SAMPLE NO. A2-T2 (BOTTOM OF TUBE)	OL	

Project No.: 100-495-2
Project: UNION POND , CONN.
o Location: TUBE A-T2, DEPTH: 0.7 FT. TO 1.67 FT.

Date: 5-1-89

Remarks:
SANDY ORGANIC SILT
DRY DENSITY: 46.82 PCF
VOLATILES EPA: 20.11%
VOLATILES NED: 16.74%

GRAIN SIZE DISTRIBUTION TEST REPORT
CORPS OF ENGINEERS - NEW ENGLAND

Fig. No. 2

SITE A - LOWER FRACTION

GRAIN SIZE DISTRIBUTION TEST DATA — Test No.: 2

Date: 5-1-89
Project No.: 100-495-2 — SITE A - LOWER FRACTION
Project: UNION POND , CONN.

Sample Data

Location of Sample: TUBE A-T2, DEPTH: 0.7 FT. TO 1.67 FT.
Sample Description: SAMPLE NO. A2-T2 (BOTTOM OF TUBE)
USCS Class: OL — Liquid limit: NP
AASHTO Class: — Plasticity index: NP

Notes

Remarks: SANDY ORGANIC SILT DRY DENSITY: 46.82 PCF
VOLATILES EPA: 20.11% VOLATILES NED: 16.74%
Fig. No.: 2

Mechanical Analysis Data

Initial
Dry sample and tare= 38.70
Tare = 0.00
Dry sample weight = 38.70
Sieve tare method

Sieve	Weight retained	Sieve tare	Percent finer
# 4	0.00	0.00	100.0
# 10	0.20	0.00	99.5
# 20	0.80	0.00	97.4
# 40	0.90	0.00	95.1
# 70	3.40	0.00	86.3
# 100	4.60	0.00	74.4
# 200	6.20	0.00	58.4

Hydrometer Analysis Data

Separation sieve is number 10
Percent -# 10 based on complete sample= 99.5
Weight of hydrometer sample: 38.7
Calculated biased weight= 38.9
Table of composite correction values:

Temp, deg C:	18.0	19.0	20.0	21.0	22.0
Comp. corr:	- 3.7	- 3.4	- 3.1	- 2.9	- 2.7

Meniscus correction only= 0.5
Specific gravity of solids= 2.43
Specific gravity correction factor= 1.058
Hydrometer type: 151H Effective depth L= 16.294964 - 0.2645 x Rm

SITE A - LOWER FRACTION

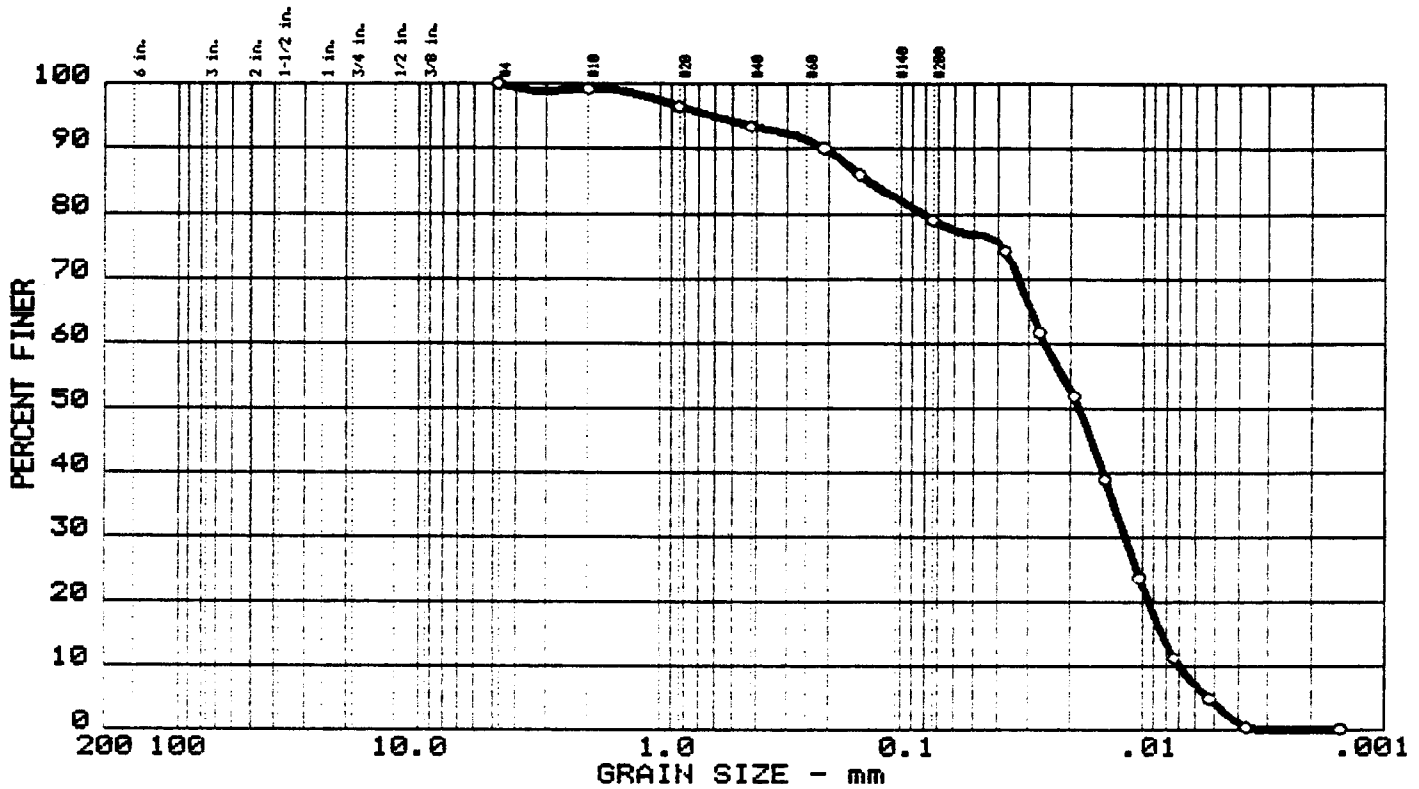
Elapsed time, min	Temp, deg C	Actual reading	Corrected reading	K	Rm	Eff. depth	Diameter mm	Percent finer
1.0	19.3	1.0150	1.0117	0.0148	15.5	12.2	0.0516	51.1
2.0	19.3	1.0120	1.0087	0.0148	12.5	13.0	0.0377	38.0
4.0	19.4	1.0100	1.0067	0.0148	10.5	13.5	0.0271	29.4
8.0	19.4	1.0085	1.0052	0.0148	9.0	13.9	0.0195	22.8
15.0	19.5	1.0070	1.0038	0.0147	7.5	14.3	0.0144	16.4
30.0	19.6	1.0060	1.0028	0.0147	6.5	14.6	0.0103	12.1
60.0	19.7	1.0050	1.0018	0.0147	5.5	14.8	0.0073	7.9
120.0	20.1	1.0040	1.0009	0.0146	4.5	15.1	0.0052	4.0
240.0	21.1	1.0030	1.0001	0.0145	3.5	15.4	0.0037	0.5
1440.0	20.9	1.0030	1.0001	0.0145	3.5	15.4	0.0015	0.3

Fractional Components

% + 3 in. = 0.0 % GRAVEL = 0.0 % SAND = 41.6
% SILT = 54.8 % CLAY = 3.6

D75= 0.15 D60= 0.081 D50= 0.050
D30= 0.0278 D25= 0.02160 D10= 0.00860
Cc = 1.1079 Cu = 9.4515

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
o	3	0.0	0.0	20.8	74.9	4.3

	LL	PI	D_{75}	D_{60}	D_{50}	D_{30}	D_{25}	D_{10}	C_c	C_u
o					0.02	0.012	0.0106	0.0070	0.77	3.6

MATERIAL DESCRIPTION	USCS	AASHTO
o SAMPLE NO. B1-T1 (TOP OF TUBE)	OH	

Project No.: 100-495-3
Project: UNION POND , CONN.
o Location: TUBE B-T1 , DEPTH: 0.0 FT. TO 0.7 FT.

Date: 5-1-89

Remarks:
ORGANIC SILT WITH SAND
DRY DENSITY: 36.83 PCF
VOLATILES EPA: 13.41%
VOLATILES NED: 11.66%

GRAIN SIZE DISTRIBUTION TEST REPORT
CORPS OF ENGINEERS - NEW ENGLAND

Fig. No. 3

SITE B - UPPER FARCTION

GRAIN SIZE DISTRIBUTION TEST DATA Test No.: 3

Date: 5-1-89
Project No.: 100-495-3 SITE B - UPPER FRACTION
Project: UNION POND , CONN.

Sample Data

Location of Sample: TUBE B-T1 , DEPTH: 0.0 FT. TO 0.7 FT.
Sample Description: SAMPLE NO. B1-T1 (TOP OF TUBE)
USCS Class: OH Liquid limit:
AASHTO Class: Plasticity index:

Notes

Remarks: ORGANIC SILT WI SAND DRY DENSITY: 36.83 PCF
VOLATILES EPA: 13.41% VOLATILES ED: 11.66%
Fig. No.: 3

Mechanical Analysis Data

Initial
Dry sample and tare = 26.00
Tare = 0.00
Dry sample weight = 26.00
Sieve tare method

Sieve	Weight retained	Sieve tare	Percent finer
# 4	0.00	0.00	100.0
# 10	0.20	0.00	99.2
# 20	0.70	0.00	96.5
# 40	0.80	0.00	93.5
# 70	0.90	0.00	90.0
# 100	1.00	0.00	86.2
# 200	1.80	0.00	79.2

Hydrometer Analysis Data

Separation sieve is number 10
Percent -# 10 based on complete sample= 99.2
Weight of hydrometer sample: 26
Calculated biased weight= 26.2
Table of composite correction values:

Temp, deg C:	18.0	19.0	20.0	21.0	22.0
Comp. corr:	- 3.7	- 3.4	- 3.1	- 2.9	- 2.7

Meniscus correction only= 0.5
Specific gravity of solids= 2.41
Specific gravity correction factor= 1.064
Hydrometer type: 151H Effective depth L= 16.294964 - 0.2645 x Rm

SITE B - UPPER FRACTION

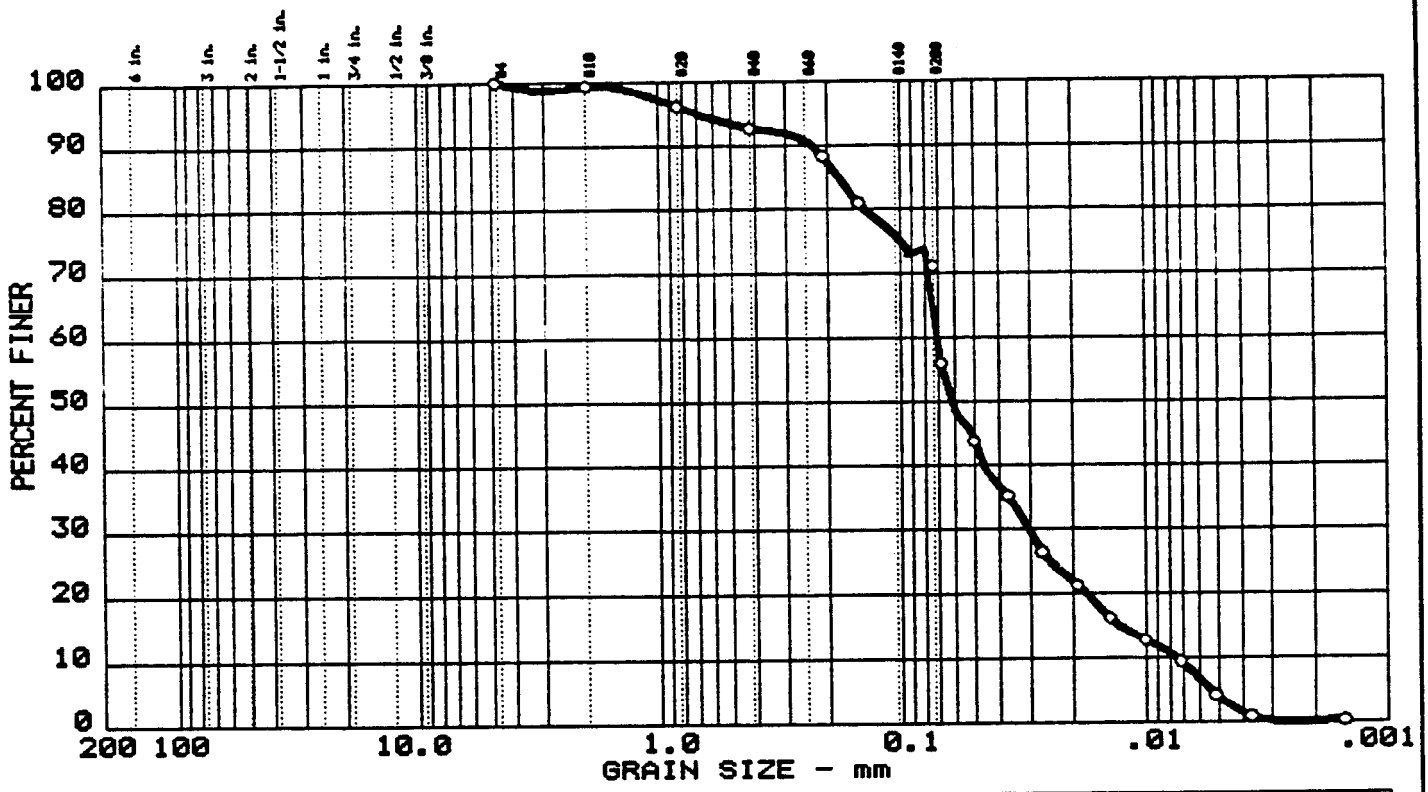
Elapsed time, min	Temp, deg C	Actual reading	Corrected reading	K	Rm	Eff. depth	Diameter mm	Percent finer
2.0	18.4	1.0150	1.0114	0.0151	15.5	12.2	0.0372	74.5
4.0	18.5	1.0130	1.0095	0.0150	13.5	12.7	0.0268	61.6
8.0	18.5	1.0115	1.0080	0.0150	12.0	13.1	0.0193	51.9
15.0	18.6	1.0095	1.0060	0.0150	10.0	13.6	0.0143	39.0
30.0	19.2	1.0070	1.0037	0.0149	7.5	14.3	0.0103	23.9
60.0	19.4	1.0050	1.0017	0.0149	5.5	14.8	0.0074	11.2
120.0	19.6	1.0040	1.0008	0.0148	4.5	15.1	0.0053	5.1
240.0	20.8	1.0030	1.0001	0.0146	3.5	15.4	0.0037	0.4
1440.0	20.6	1.0030	1.0000	0.0147	3.5	15.4	0.0015	0.1

Fractional Components

% + 3 in. = 0.0 % GRAVEL = 0.0 % SAND = 20.8
% SILT = 74.9 % CLAY = 4.3

D75= 0.04 D60= 0.026 D50= 0.018
D30= 0.0118 D25= 0.01056 D10= 0.00705
Cc = 0.7718 Cu = 3.6266

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
o	4	0.0	0.0	28.9	67.3	3.8

	LL	PI	D_{75}	D_{60}	D_{50}	D_{30}	D_{25}	D_{10}	C_c	C_u
o	132.0	59.5	0.10		0.07	0.030	0.0247	0.0074	1.76	9.4

MATERIAL DESCRIPTION	USCS	AASHTO
o SAMPLE NO. B2-T1 (BOTTOM OF TUBE)	OH	

Project No.: 100-495-3
Project: UNION POND , CONN.
o Location: TUBE B-T1, DEPTH: 1.1 FT. TO 1.75 FT.

Date: 5-1-89

Remarks:
ORGANIC SILT WITH SAND
DRY DENSITY: 36.83 PCF
VOLATILES EPA: 29.80%
VOLATILES NED: 27.44%

GRAIN SIZE DISTRIBUTION TEST REPORT
CORPS OF ENGINEERS - NEW ENGLAND

Fig. No. 4

SITE B - LOWER FRACTION

GRAIN SIZE DISTRIBUTION TEST DATA Test No.: 4

Date: 5-1-89
Project No.: 100-495-3 SITE B - LOWER FARCTION
Project: UNION POND , CONN.

Sample Data

Location of Sample: TUBE B-T1, DEPTH: 1.1 FT. TO 1.75 FT.
Sample Description: SAMPLE NO. B2-TI (BOTTOM OF TUBE)
USCS Class: OH Liquid limit: 132.0
AASHTO Class: Plasticity index: 59.5

Notes

Remarks: ORGANIC SILT WITH SAND DRY DENSITY: 36.83 PCF
VOLATILES EPA: 29.80% VOLATILES NED: 27.44%
Fig. No.: 4

Mechanical Analysis Data

Initial
Dry sample and tare= 48.10
Tare = 0.00
Dry sample weight = 48.10
Sieve tare method

Sieve	Weight retained	Sieve tare	Percent finer
# 4	0.00	0.00	100.0
# 10	0.30	0.00	99.4
# 20	1.50	0.00	96.3
# 40	1.70	0.00	92.7
# 70	2.10	0.00	88.4
# 100	3.60	0.00	80.9
# 200	4.70	0.00	71.1

Hydrometer Analysis Data

Separation sieve is number 10
Percent -# 10 based on complete sample= 99.4
Weight of hydrometer sample: 48.1
Calculated biased weight= 48.4
Table of composite correction values:

Temp, deg C:	18.5	19.0	20.0	21.0	22.0
Comp. corr:	- 3.7	- 3.4	- 3.1	- 2.9	- 2.7

Meniscus correction only= 0.5
Specific gravity of solids= 2.46
Specific gravity correction factor= 1.049
Hydrometer type: 151H Effective depth L= 16.294964 - 0.2645 x Rm

SITE B - LOWER FRACTION

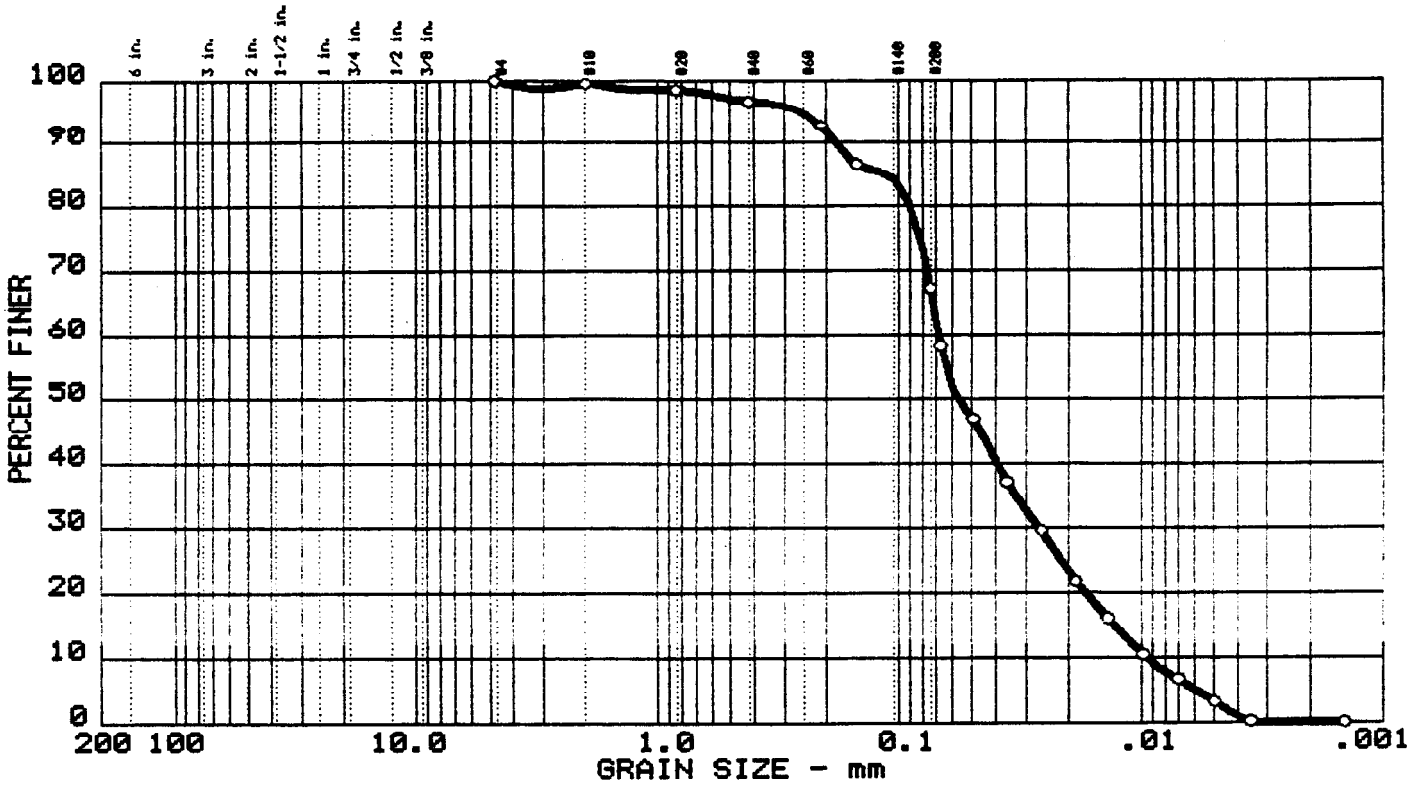
Elapsed time, min	Temp, deg C	Actual reading	Corrected reading	K	Rm	Eff. depth	Diameter mm	Percent finer
0.5	19.0	1.0195	1.0161	0.0147	20.0	11.0	0.0689	56.0
1.0	19.0	1.0160	1.0126	0.0147	16.5	11.9	0.0507	43.9
2.0	19.0	1.0135	1.0101	0.0147	14.0	12.6	0.0368	35.2
4.0	19.1	1.0110	1.0076	0.0147	11.5	13.3	0.0267	26.6
8.0	19.1	1.0095	1.0061	0.0147	10.0	13.6	0.0192	21.3
15.0	19.2	1.0080	1.0047	0.0146	8.5	14.0	0.0142	16.2
30.0	19.3	1.0070	1.0037	0.0146	7.5	14.3	0.0101	12.8
60.0	19.4	1.0060	1.0027	0.0146	6.5	14.6	0.0072	9.5
120.0	19.4	1.0045	1.0012	0.0146	5.0	15.0	0.0052	4.2
240.0	19.5	1.0035	1.0003	0.0146	4.0	15.2	0.0037	0.9
1440.0	18.9	1.0035	1.0001	0.0147	4.0	15.2	0.0015	0.2

Fractional Components

% + 3 in. = 0.0 % GRAVEL = 0.0 % SAND = 28.9
% SILT = 67.3 % CLAY = 3.8

D75= 0.10 D60= 0.070 D50= 0.066
D30= 0.0303 D25= 0.02466 D10= 0.00745
Cc = 1.7620 Cu = 9.4189

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
○	5	0.0	0.0	32.7	64.0	3.3

	LL	PI	D_{75}	D_{60}	D_{50}	D_{30}	D_{25}	D_{10}	C_c	C_u
○	NP	NP	0.08		0.06	0.026	0.0214	0.0095	1.06	7.2

MATERIAL DESCRIPTION	USCS	AASHTO
○ SAMPLE NO. C2-T2 (TOP OF TUBE)	OL	

Project No.: 100-495-6
Project: UNION POND , CONN.
○ Location: TUBE C-T2 , DEPTH: 0.0 FT. TO 0.7 FT.

Date: 5-2-89

GRAIN SIZE DISTRIBUTION TEST REPORT
CORPS OF ENGINEERS - NEW ENGLAND

Remarks:
SANDY ORGANIC SILT
DRY DENSITY: 35.59 PCF
VOLATILES EPA: 14.38%
VOLATILES NED: 12.64%

Fig. No. 5

SITE C - UPPER FRACTION

GRAIN SIZE DISTRIBUTION TEST DATA Test No.: 5

Date: 5-2-89
Project No.: 100-495-6 SITE C - UPPER FRACTION
Project: UNION POND , CONN.

Sample Data

Location of Sample: TUBE C-T2 , DEPTH: 0.0 FT. TO 0.7 FT.
Sample Description: SAMPLE NO. C1-T2 (TOP OF TUBE)
USCS Class: OL Liquid limit: NP
AASHTO Class: Plasticity index: NP

Notes

Remarks: SANDY ORGANIC SILT DRY DENSITY: 35.59 PCF
VOLATILES EPA: 14.38% VOLATILES NED: 12.64%
Fig. No.: 5

Mechanical Analysis Data

Initial
Dry sample and tare= 42.20
Tare = 0.00
Dry sample weight = 42.20
Sieve tare method

Sieve	Weight retained	Sieve tare	Percent finer
# 4	0.00	0.00	100.0
# 10	0.20	0.00	99.5
# 20	0.40	0.00	98.6
# 40	0.80	0.00	96.7
# 70	1.70	0.00	92.7
# 100	2.60	0.00	86.5
# 200	8.10	0.00	67.3

Hydrometer Analysis Data

Separation sieve is number 10
Percent -# 10 based on complete sample= 99.5
Weight of hydrometer sample: 42.2
Calculated biased weight= 42.4
Table of composite correction values:

Temp, deg C:	18.0	19.0	20.0	21.0	22.0
Comp. corr:	- 3.7	- 3.4	- 3.1	- 2.9	- 2.7

Meniscus correction only= 0.5
Specific gravity of solids= 2.56
Specific gravity correction factor= 1.022
Hydrometer type: 151H Effective depth L= 16.294964 - 0.2645 x Rm

SITE C - UPPER FRACTION

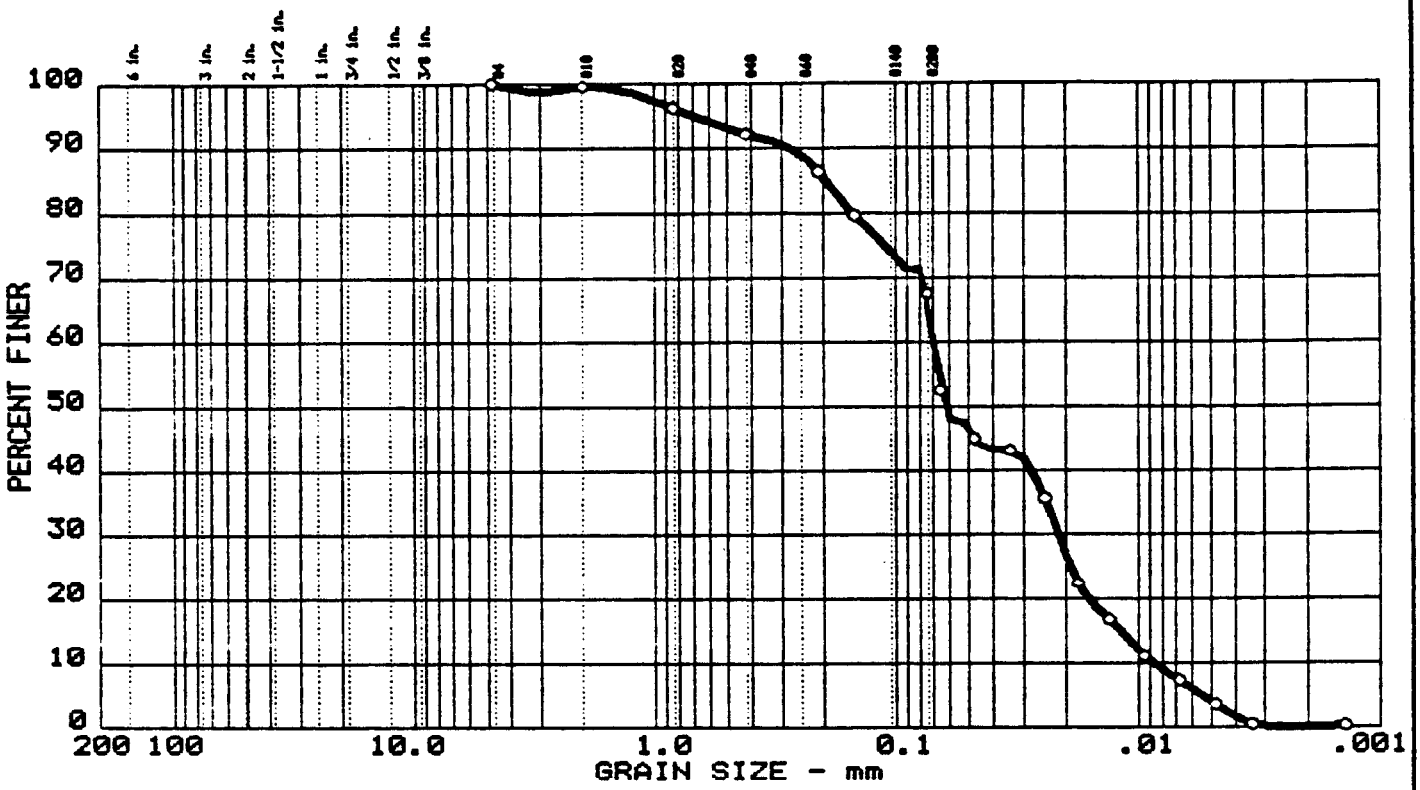
Elapsed time, min	Temp, deg C	Actual reading	Corrected reading	K	Rm	Eff. depth	Diameter mm	Percent finer
0.5	19.0	1.0185	1.0151	0.0142	19.0	11.3	0.0675	58.4
1.0	19.0	1.0155	1.0121	0.0142	16.0	12.1	0.0493	46.8
2.0	19.0	1.0130	1.0096	0.0142	13.5	12.7	0.0358	37.2
4.0	19.1	1.0110	1.0076	0.0142	11.5	13.3	0.0258	29.5
8.0	19.1	1.0090	1.0056	0.0142	9.5	13.8	0.0186	21.8
15.0	19.2	1.0075	1.0042	0.0142	8.0	14.2	0.0138	16.1
30.0	19.3	1.0060	1.0027	0.0142	6.5	14.6	0.0099	10.4
60.0	19.4	1.0050	1.0017	0.0141	5.5	14.8	0.0070	6.7
120.0	19.8	1.0040	1.0008	0.0141	4.5	15.1	0.0050	3.3
240.0	20.8	1.0030	1.0001	0.0139	3.5	15.4	0.0035	0.2
1440.0	20.6	1.0030	1.0000	0.0139	3.5	15.4	0.0014	0.1

Fractional Components

% + 3 in. = 0.0 % GRAVEL = 0.0 % SAND = 32.7
% SILT = 64.0 % CLAY = 3.3

D75= 0.08 D60= 0.069 D50= 0.057
D30= 0.0264 D25= 0.02136 D10= 0.00954
Cc = 1.0617 Cu = 7.1945

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
○	6	0.0	0.0	32.4	63.5	4.1

	LL	PI	D_{75}	D_{60}	D_{50}	D_{30}	D_{25}	D_{10}	C_c	C_u
○	NP	NP	0.11		0.06	0.021	0.0191	0.0086	0.76	8.1

MATERIAL DESCRIPTION	USCS	AASHTO
○ SAMPLE NO. C2-T2 (BOTTOM OF TUBE)	OL	

Project No.: 100-495-6
Project: UNION POND , CONN.
○ Location: TUBE C-T2 , DEPTH: 0.7 FT. TO 1.4 FT.

Date: 5-2-89

GRAIN SIZE DISTRIBUTION TEST REPORT
CORPS OF ENGINEERS - NEW ENGLAND

Remarks:
SANDY ORGANIC SILT
DRY DENSITY: 35.59 PCF
VOLATILES EPA: 16.40%
VOLATILES NED: 14.92%

Fig. No. 6

SITE C - LOWER FRACTION

GRAIN SIZE DISTRIBUTION TEST DATA — Test No.: 6

Date: 5-2-89
Project No.: 100-495-6 — SITE C - LOWER FRACTION
Project: UNION POND , CONN.

Sample Data

Location of Sample: TUBE C-T2 , DEPTH: 0.7 FT. TO 1.4 FT.
Sample Description: SAMPLE NO. C2-T2 (BOTTOM OF TUBE)
USCS Class: OL — Liquid limit: NP
AASHTO Class: — Plasticity index: NP

Notes

Remarks: SANDY ORGANIC SILT DRY DENSITY: 35.59 PCF
VOLATILES EPA: 16.40% VOLATILES NED: 14.92%
Fig. No.: 6

Mechanical Analysis Data

	Initial
Dry sample and tare=	42.30
Tare =	0.00
Dry sample weight =	42.30

Sieve tare method

Sieve	Weight retained	Sieve tare	Percent finer
# 4	0.00	0.00	100.0
# 10	0.20	0.00	99.5
# 20	1.40	0.00	96.2
# 40	1.70	0.00	92.2
# 70	2.40	0.00	86.5
# 100	2.90	0.00	79.7
# 200	5.10	0.00	67.6

Hydrometer Analysis Data

Separation sieve is number 10
Percent -# 10 based on complete sample= 99.5
Weight of hydrometer sample: 42.3
Calculated biased weight= 42.5
Table of composite correction values:

Temp, deg C:	18.0	19.0	20.0	21.0	22.0
Comp. corr:	- 3.7	- 3.4	- 3.1	- 2.9	- 2.7

Meniscus correction only= 0.5
Specific gravity of solids= 2.65
Specific gravity correction factor= 1.000
Hydrometer type: 151H Effective depth L= 16.294964 - 0.2645 x Rm

SITE C - LOWER FRACTION

Elapsed time, min	Temp, deg C	Actual reading	Corrected reading	K	Rm	Eff. depth	Diameter mm	Percent finer
0.5	20.1	1.0170	1.0139	0.0136	17.5	11.7	0.0658	52.6
1.0	20.1	1.0150	1.0119	0.0136	15.5	12.2	0.0476	45.0
2.0	20.1	1.0145	1.0114	0.0136	15.0	12.3	0.0338	43.2
4.0	20.2	1.0125	1.0094	0.0136	13.0	12.9	0.0244	35.7
8.0	20.2	1.0090	1.0059	0.0136	9.5	13.8	0.0179	22.4
15.0	20.3	1.0075	1.0045	0.0136	8.0	14.2	0.0132	16.9
30.0	20.3	1.0060	1.0030	0.0136	6.5	14.6	0.0095	11.2
60.0	20.3	1.0050	1.0020	0.0136	5.5	14.8	0.0068	7.4
120.0	20.4	1.0040	1.0010	0.0136	4.5	15.1	0.0048	3.7
240.0	21.2	1.0030	1.0001	0.0134	3.5	15.4	0.0034	0.5
1440.0	20.8	1.0030	1.0001	0.0135	3.5	15.4	0.0014	0.2

Fractional Components

% + 3 in. = 0.0 % GRAVEL = 0.0 % SAND = 32.4
% SILT = 63.5 % CLAY = 4.1

D75= 0.11 D60= 0.070 D50= 0.064
D30= 0.0215 D25= 0.01912 D10= 0.00864
Cc = 0.7647 Cu = 8.0631

HOCKANUM RIVER AT UNION POND
MANCHESTER, CONNECTICUT

NAVIGATION IMPROVEMENT STUDY
RECONNAISSANCE REPORT

APPENDIX E

ENVIRONMENTAL ANALYSIS

Prepared by

William A. Hubbard
and
Kirk E. Bargerhuff

Environmental Resources Section
Impact Analysis Branch

June 1989

APPENDIX E
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APPENDIX E
ENVIRONMENTAL ANALYSIS

I. PROJECT DESCRIPTION

The environmental issues involved with the dredging of a section of Union Pond in Manchester, Connecticut, involve the quality and fate of the dredged material, the ultimate water quality of the pond for contact recreation and the impacts of the proposed development of recreation facilities on wetlands and water resources.

II. COORDINATION

Project information letters were mailed to the following people prior to the preparation of this reconnaissance report.

Mr. Douglas A. Thompson, U. S. Environmental Protection Agency
Mr. Gordon E. Beckett, U.S. Fish and Wildlife Service
Mr. Horace C. Brown, Connecticut Office of Policy Management
Ms. Nancy Murray, CT Department of Environmental Protection (DEP)
Ms. Leslie Carothers, CT DEP
Mr. Denis Cunningham, CT DEP - Water Resources Unit

A site visit was made on 16 May 1989 to inform attending state and local agencies as well as interested parties of the proposed project and to discuss any concerns. The following were in attendance and should be coordinated with during the remaining phases of the project:

Mark Habel - NED
Kerrin Dame - NED
Karen Worden - Fuss O
Lynn Pike DiSonto - Manchester Planning Commission
Robert Croce - U. S. Representative Barbara Kennelly
Office
Stephen Andrzejewski - CT DEP, Water Resources Unit
Amy Sullivan - CT DEP, Water Resources Unit
Chuck Lee - CT DEP, Water Compliance Unit
Brian Murphy - CT DEP, Fisheries Bureau

Letters requesting comments concerning the project were mailed 18 May 1989 to the following people:

Mr. Brian D. Murphy - CT Department of Environmental
Protection Bureau of Fisheries
Mr. Stephen Andrzejewski - CT DEP, Water Resources
Mr. Charles Lee - CT DEP Water Compliance Unit

The following correspondence have been received by the Corps of Engineers, NED:

Nancy Murray, CT DEP
Gordon E. Beckett, U.S. Fish and Wildlife Service
Brian D. Murphy - CT DEP, Bureau of Fisheries

Additional correspondence per telephone were from the following:

U.S. Soil Conservation Service
CT Division of Hazardous Waste

An additional site visit was conducted on 23 May 1989 to conduct a biological and archaeological appraisal of the study area.

III. AFFECTED ENVIRONMENT

A. General Description:

The project area lies entirely within the suburban environment of the city of Manchester. The area consists of an aquatic environment, bordered by northwest and southeast facing slopes of upland eastern deciduous forest, and open grassland. Union Pond is approximately 52 acres and is formed by the damming of the Hockanum River. The dam is located in the southwest corner of the project area. The Hockanum River enters from the north.

B. Area Description:

The following observations and analyses were made during a site visit 23 May 1989 and through coordination during winter/spring 1989.

1. Aquatic Environment

The Hockanum River empties into Union Pond from the north end bringing an influx of industrial and agricultural runoff and siltation. The water quality of Union Pond is presently Class C with a goal of Class B.

The southeast corner contains inlets of surface film and has a stagnant odor, as well as the shoreline having a high degree of litter. Water samples taken near the dam revealed fresh water invertebrates of ostracods, copepods, nomatodes, tricopteran, larvae, and fish, which are common to freshwater ponds. Wildlife species observed were Canada geese (Branta canadensis).

No wetlands were observed within the project area. Emergent wetland species are limited because of the topographic slope of the area.

2. Upland Environment

Union Pond is encompassed by a band of upland deciduous forest typed interspersed with suburban Manchester. The northeast side of the project area contains a housing complex leading to the waters edge (See Main Report - Figure 1). Adjacent to the housing complex, the east side is a steep northwest facing slope containing a pole and saw-timber sized overstory of oaks (Quercus sp.), Sugar maple (Acer saccharum), Yellow birch (Betula alleghaiensis), paper birch (Betula papyrifera), and American beech (Fagus grandifolia). Canopy closure varies from between 50 - 90 percent. The forest runs directly to the water edge.

Understory varies from sparse to medium dense sapling and small pole sized birch, oak , and maple. Hydric tolerant tree species of witch hazel (Hamamelis sp.), elm (Ulnus sp.), and flowering dogwood (Cornus racemosa) also were observed. Patches of poison ivy (Rhus radicans), blueberry (Vaccinium corymbosum), Virginia creeper (Parthenocissus quinquefolia), and rose (Rosa sp.) constituted the understory.

Regeneration in open areas appears good to excellent, except along unmarked trails where soil compaction reduces growth. Unmarked trails run throughout the upland sites, especially near high human impact areas.

This area contained a diversified number of song birds. Observation included species of black and white warbler (Mniotilta varia), bluejay (Cyanocitta cristata), grackle (Quiscalus quiscula), starlings (Sturnus vulgaris), belted kingfisher (Ceryle alcyon), and sparrows. Other wildlife species included gray squirrel (Sciurus carolinensis), and chipmunks (Taimus sp.). It would be expected that a higher diversity of songbird species would be found with additional sampling. Raccoons (Procyon lotor), rabbits (Sylvilagus sp.), fox squirrels (Squirus niger),

white-footed mice (Permyscus sp.), and screech owls (Otus asio) may also be inhabiting the area.

The habitat diversifies along the southern area of the lake and by the dam itself. Private property runs to the water edge. The southeast section of the project area has two inlets with approximately six acres of open grassland which the city would like to develop as a recreational picnic site. Surface film filled one inlet and in both inlets, a high amount of organic matter was observed in the aquatic environment. Litter encompasses the entire shoreline and the southeast area has a stagnant odor. Additionally, there is a small island in between the two inlets. The island appears predominantly material from the original construction of the dam. The island vegetation appears to be similar to upland communities.

Upland habitat surrounds the western section of the project, and is much like the opposing side. Topography is less sloped.

3. Disposal Site

One of the proposed disposal sites is located adjacent to the northwest one-third of Union Pond. Habitat is different from the rest of the project area. This area is predominantly a sand and gravel pit and has been recently impacted by sewage or water line construction. Brush piles scatter the landscape as well as many forms of garbage and junk. A filled-in lowland site is apparent.

Smooth sumac (Rhus glabra), sapling and pole sized cottonwood (Poplus deltoides), quaking aspen (Populus tremloides), and big-tooth aspen (Populus grandidentata), were the dominant species. Sapling white pine (Pinus strobus), has been planted along the slope adjacent and to the water edge Additionally, the area has a fair amount of edge species bordering the slopes to the waters edge.

A sewage and/or water conveyance system delineates the back of the sand and gravel pit where transition to sawtimber and pole sized habitat occurs. Red oak and white oak (Quercus alba), Aspen, and cottonwood are present, oaks being the dominant species. The understory is of a medium to thick density of blueberry, dogwood, cherry (Prunus sp.), sapling oaks, aspen and cottonwood. Wildlife habitat of this type would be expected to promote rabbits, squirrels, and early successional songbird species.

IV. HISTORIC AND ARCHAEOLOGICAL RESOURCES

The Hockanum River was an important hydropower stream for the town of Manchester from the late 18th to the early 20th centuries. Two industries in particular, textile manufacturing and paper production developed into large enterprises on the river. The Union Manufacturing Company located at Union Pond grew to be the second largest employer in Manchester during the second half of the 19th century. Kenney and Wood's Paper Mill, located downstream of the Union Company, also did a good business during the 1800s.

There were three paper mills and a cotton factory located in Manchester as early as 1794. Three of these mills were located on the Hockanum River. The Butler and Hudson Paper Mill began operations on the Hockanum River just north of the present Union Pond in 1784. It remained in operation until at least 1850. The Samuel Pitkin Mill was built in 1794. The factory was constructed at the southwest end of Union Pond and may have been the company which first built a dam and created this mill pond on the Hockanum River. This mill was the first cotton mill built in Connecticut and developed into a relatively large factory. The Samuel Pitkin mill became the Union Manufacturing Company sometime during the early 19th century.

The embargo enforced by Britain during the War of 1812 stimulated industrial growth in the United States. By 1939 Manchester was described as an important manufacturing town on the Hockanum River. There were seven paper mills, two powder mills, six woolen mills and two cotton factories. The town contained three discrete villages, one of which was Union Village. The Union Manufacturing Company employed 250 people and had several mills in operation at Union Pond by 1850.

In 1849 the Hartford, Providence and Fishkill Railroad Company completed a railway line between Manchester and Hartford. Service to Willimantic via Union Village began in 1851. These new transportation facilities further increased the rate of growth of industry in Manchester. The 1860 census listed nine paper mills and nine textile establishments, four producing cotton. The Union Manufacturing Company produced primarily cotton ginghams and employed 300 men and women.

This prosperity continued after the Civil War. A high protective tariff was initiated by the Federal government to aid American industries to rebuild after the war by giving U.S. products an advantage over lower priced foreign goods. This tariff in particular benefited the textile manufacturers. In 1866 the

Union Manufacturing Company had four plants at Union Village as well as a flour and grist mill and a factory village of tenant houses. According to an 1869 map of the village (Baker and Tilden, 1869) there were at least 35 structures south of Union Pond which were under the ownership of the textile company. In 1865-66 the mill constructed a new stone dam. It was the third dam built at this location at the south end of Union Pond. This dam is still present. However, subsequent structures have been built over and around it so it is no longer visible.

The company's peak year was 1882 when the mills produced over 50,000 yards of gingham per week and employed 350 people. For unknown reasons, the business began to decline several years later. A large sum of money embezzled from the firm's treasury by a company officer was a contributing factor. In 1888 the firm still employed 340 people, but had been placed in receivership. By 1890 the Manchester Business Directory does not list the company.

The Hormel Brothers Fullers and Wool Scourers began operations in part of the Union plant. They employed 45 people. However users of water west of Union Pond complained that the Hormels were polluting the Hockanum River. The Hockheimer Brothers took over the wool scouring business for a short time, but then abandoned the plants. Around 1900 a large silk manufacturing company which also operated in Manchester, the Cheney Brothers, purchased the water rights of the defunct Union Manufacturing Company and used the water power to generate electricity. Therefore, no other manufacturer could operate on this section of the river.

V. WATER QUALITY:

Contaminant analysis of three stations (D, E, and F; see Appendix D - Figure D-3, page D-13) in the vicinity of the proposed dredging area indicates acceptable water quality levels for fisheries. Sites D, E, and F had water samples taken at them. These samples were analyzed for aluminum (Al), arsenic (As), calcium (Ca), cadmium (Cd), chromium (Cr), copper (cu), iron (Fe), lead (Pb), magnesium (Mg), manganese (Mn), mercury (Hg), nickel (Ni), Zinc (Zn). alkalinity, residual chlorine, nitrogen (TKN), nitrite, nitrate, and orthophosphorus. This limited sample only describes the Spring 1989 condition for the listed parameters. The data suggests slight elevations in iron and manganese, but no significant toxics concentrations.

File data supplied by the State of Connecticut (Mr. Brian Murphy - CT DEP - letter dated 22 May 1989) indicates the Pond

experiences regular hypoxia. These events of low dissolved oxygen were last studied in 1977. Levels in July 1977 reached as low as 0.1 ppm in 12°C waters. This phenomena requires further documentation to evaluate its effect on recreational management of the system.

Mr. Murphy indicated the dominant freshwater species were Bluegill (Lepomis macrochirus), White sucker (Catostomus commersoni), and Golden shiner (Notemigonus crysoleucas). Additional inhabitants were Brown bullhead (Ictalurus nebulosus), Common carp (Cyprinus carpio), white catfish (Ictalurus catus), and Yellow perch (Perca flavescens). This information was supplied from a 1977 report (ref. Mr. Murphy, CT DEP).

VI. DREDGED MATERIAL DISPOSAL ALTERNATIVES

Coordination with state (DEP-Water Quality Unit) and local (Project Sponsors) officials revealed the potential for chemical contamination in the upstream watershed. Various industries and two wastewater treatment plants are located upstream. The material to be dredged underwent chemical analysis of the more recent (post - 1900) fine grained material. Two samples of the depositional fringe and one of the historic wetland were analyzed for physical properties (grain size) and the standard suite of bulk chemicals (i.e. Cd; Cr; Cu; Hg; Pb; Zn; As; PCB; DDT; NO2/NO3; SO4; P; COD; and oil and grease). These evaluations were intended to guide the decision making process for disposal of the dredged material.

Alternatives for dredged material disposal will have a direct bearing on project costs and subsequently the Benefit/Cost Ratio. Potential disposal alternatives include nearby gravel pits, any local landfill, (e.g. Manchester or East Hartford, South and East Winsor), the construction of island/wetland habitats in the pond, or the possibility of the sale or mining of appropriate dredged material for commercial purposes.

The nearby gravel pits could be filled with the material depending on the groundwater impacts related to the contaminant nature of the dredged material. Pipeline hydraulic dredging could be used, a relatively inexpensive procedure.

The disposal of the material for landfill cover would require mechanical dredging with numerous truck trips, increasing costs dependent on the haul distance. This alternative is less dependent on minor chemical contamination, but would require adherence to Connecticut's Solid Waste Management guidelines.

The construction of an island or wetland in the pond or its periphery would require mechanical dredging with possible construction of a dike or containment structure. This option also would reduce the available open water recreation area, but add biological diversity.

Analysis of the physical properties of the dredged material (grain size, water content, etc.) would determine its utility for sale as construction material. Also, future analysis will be needed to describe potential of rock ledge in the poroject area. Blasting of rock would significantly increase project costs.

VII. SEDIMENT CHEMISTRY:

Sediment and Water samples were analyzed for chemical contamination at six sites (see Appendix D, Figure D-2, page D-7, and Figure D-3, page D-13). Three sites (A,B, and C) were analyzed for sediment chemistry. These determinations included contaminants such as arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), lead (Pb), mercury (Hg), nickel (Ni), Zinc (Zn), petroleum hydrocarbons (PHC's) and total polychlorinated biphenyl compounds (PCBs). The results of these analyses are presented in Tables E-1 and E-2.

Prior to disposal, dredged materials are generally evaluated for their chemical contamination level. This chemical signature is representative of the pollutant input to the area to be dredged. Industrial discharges, wastewater treatment systems,and non-point source runoff all contribute chemicals in solution and absorbed to solid particles that ultimately reside in the sediments on lake bottoms. Average chemical concentrations (Table E-3) represewnts the probable chemical signature of the material proposed to be disposed. Table E-4 provides a synopsis of the 1980 New England River Basin Commission's classification system for dredged material. This provides a guideline for aquatic disposal only. Other analyses are required for upland disposal characterization.

The material to be dredged is primarily organic silt with interspersed sand horizons. Generally, the upper 30 cm is a brown sandy silt horizon underlain with a 2 cm sand horizon. The next layer is approximately 4 cm of dark brown sandy silt with another 2cm underlay of light brown sand. The lowest horizon sampled was another dark brown sandy silt. These horizon bandings are probably indicative of the various episodes of pond draining and refilling. Grain size distributions and mechanical analysis data are in Appendix D-1 of this report.

Chemically, the proposed dredged material is contaminated with various metals to sampling depth. PCB concentration was also evident. The likely source of these contaminants is attributable to upstream discharges, but this limited sampling did not record any significant contaminant elevations in the water column that correlates with sediment elevations.

A. Arsenic

Arsenic is released into the aquatic environment through mineral dissolution, industrial discharges or pesticide applications. Typical sediment concentrations average 6 - 13 ppm (Barr, 1987). Concentration of arsenic in dredged material are considered low for aquatic disposal in the less than 10 ppm range and high in the greater than 20 ppm range (NERBC, 1980).

The typical levels reported by Barr (1987) of 6-13 ppm is in good agreement with the 6.6 ppm average (Standard Deviation = S.D. = 5.61) found here. Only one data point (Station B - bottom) had moderate (16.5ppm) arsenic. All other samples exhibited low concentrations of arsenic.

B. Cadmium

Cadmium enters the aquatic environment through deterioration of galvanized pipe or industrial discharges. Barr (1987) indicated typical concentrations in unpolluted aquatic environment are less than 1 ppm and moderate levels for dredged material disposal (NERBC, 1980) range from 3 - 7 ppm.

Sampling in this project area revealed moderate cadmium contamination with a mean concentration of 4.1 ppm (S.D. = 3.35). This average equates those values below instrument detection level to that level (i.e. 0.842 ppm for A and 1.19ppm for B). The lower strata sampled at Station A had a high concentration of 9.91 ppm for cadmium.

C. Chromium

Chromium enters the aquatic environment from industrial waste (salts) and from corrosion control (chromate compound) in cooling waters. Barr (1987) indicated concentrations of chromium in ''clean sediments'' as 63-100ppm. NERBC (1980) listed 100-300ppm as the moderate range for chromium contamination.

The average of all six samples revealed high levels of chromium at 668.35 ppm (S.D.=751.3). In particular, the lower station A strata had 1900 ppm and the lower Station C had 1300 ppm of chromium.

D. Copper

Copper enters the aquatic system from industrial uses and applications as a biological control. ''Clean'' environments are reported by Barr (1987) as having 10ppm levels and polluted ones range 37-225 ppm. Typical aquatic concentrations average 48 ppm. Concentrations considered moderate by NERBC (1980) ranged between 200-400 ppm. This sampling exhibited mostly low copper levels. The average was 210.8 ppm (S.D.=136.0), however, placing it in the moderate NERBC (1980) category. The lower Station A (398 ppm) and C (324 ppm) layers were particularly elevated.

E. Lead

Lead enters watersheds from industrial, mine or smelter discharge and from combustion of leaded fuels. Natural lead levels are in the 20-40 ppm range (Barr, 1987). The NERBC (1980) moderate range was 100 to 200 ppm. The average lead content at these stations was 315.6 ppm (S.D.=191.0). The highest concentration was at the lower Station A strata at 615 ppm. These values represent an area of high lead contamination.

F. Mercury

Mercury enters aquatic systems as organic and inorganic salts, often bound to organic matter. It was historically used in paints as a biocide as a biological(fouling) control. Barr (1987) reported concentrations in the 0.1 to 0.4 ppm range. NERBC (1980) moderate range is 0.5 to 1.5 ppm. The six samples analyzed from this study revealed a moderate average sediment concentration of mercury at 0.96 ppm (S.D.=0.84). The Station B lower strata was most contaminated with a high mercury concentration of 2.47 ppm.

G. Nickel

Nickel is commonly used in industrial processes, herbicides and wood preservatives, or released through lead and copper alloy corrosion. Barr (1987) reported average sediment concentrations to be 6-13 ppm. The NERBC (1980) moderate category ranged 50 to 100 ppm. The average nickel sediment concentration at Union Pond was 21.0 ppm (S.D. = 12.52) This average and all values were in the low (less than 50 ppm) category .

H. Zinc

Zinc is found in aquatic systems from corrosion of galvanized iron and grass as well as from industrial discharges.

Barr (1987) reported concentrations in the 38 to 55 ppm for typical sediments with polluted substrates ranging to 600 ppm. The NERBC (1980) moderate classification range is 200 - 400 ppm.

These sediment samples exhibited an average of 607.7 ppm (S.D.=474.7) of zinc. This average itself is high, but one sample, in particular (lower Station C strata) was at 1500 ppm. All samples, except upper strata A, were in high concentrations.

I. Petroleum Hydrocarbons (PHC)

Petroleum hydrocarbons are a subset of oil and grease determinations, specifically those organic compounds of petroleum origin. A majority of sediment oil and grease determinations can be expected to be of petroleum origins in combination with biological lipids. This measurement therefore is an indication of the ''oily'' contamination of the substrate that is derived from a petroleum products' origin.

The average PHC level for all six samples was 4282.0 (S.D.= 6852.5). This high indicates oil contamination with the lower Station C strata the highest at 18,000 ppm or 1.8 % PHC.

J. Polychlorinated Biphenyl Compounds (PCB)

Polychlorinated Biphenyls are organic compounds manufactured industrially between 1929 and 1977. Their chemical stability made them an attractive industrial dielectric coolant and lubricant, as well as giving them environmental persistence. There are approximately 210 different chemical isomers that were commercially combined to form ''Arochlors'', a commercial U.S. trade name. PCB levels in dredged material are considered by NERBC (1980) as high above the 1.0 ppm range. Historical levels of sediment PCB would be zero since it is a man made compound. This sampling average 0.46 ppm (S.D.=0.49) of PCB in the sediment. Only upper strata Station C was high in PCB, having a 1.15 ppm concentration.

In summary, the Union Pond sediments proposed to be dredge are highly contaminated with chromium, lead, and zinc. Moderate levels of contamination were found for cadmium, copper and mercury. Petroleum hydrocarbons were prevalent and some areas exhibit PCB contamination. these values indicate the material would not be suitable for aquatic disposal without biological (bioassay/bioaccummulation) testing. These levels are not uncommon for industrialized watersheds and are certainly well below superfund (TOSCA, RCRA, CERCLA) levels.

TABLE E-1
SEDIMENT CHEMISTRY RESULTS
UNION POND, MANCHESTER, CT

NUL SAMPLE NO.:	5697	FIELD DESCRIPTION:	A - Top
	5698		A - Bottom
	5699		B - Top
	5700		B - Bottom

MATERIAL DESCRIPTION: SEDIMENT

PARAMETER	5697	5698	5699	5700
Aluminum	5300 ppm	12200 ppm	13000 ppm	8400 ppm
Arsenic	0.793 ppm	16.5 ppm	1.92 ppm	7.4 ppm
Calcium	1300 ppm	1200 ppm	2400 ppm	1800 ppm
Cadmium	< 0.842 ppm	9.91 ppm	4.41 ppm	< 1.19 ppm
Chromium	57.3 ppm	1900 ppm	239 ppm	184 ppm
Copper	35.3 ppm	398 ppm	223 ppm	89.6 ppm
Iron	8800 ppm	13200 ppm	13500 ppm	8500 ppm
Lead	52.7 ppm	615 ppm	189 ppm	311 ppm
Magnesium	1600 ppm	2300 ppm	3100 ppm	2200 ppm
Manganese	265 ppm	114 ppm	338 ppm	462 ppm
Mercury	0.158 ppm	1.35 ppm	0.604 ppm	2.47 ppm
Nickel	7.58 ppm	40.1 ppm	19.5 ppm	11.5 ppm
Zinc	101 ppm	534 ppm	434 ppm	658 ppm
TOC				
Petroleum Hydrocarbons	262 ppm	3760 ppm	1110 ppm	260 ppm
Total PCBs	0.20 ppm	< 0.01 ppm	0.82 ppm	< 0.01 ppm

NUL SAMPLE NO.:	5701	FIELD DESCRIPTION:	C - Top
	5702		C - Bottom

PARAMETER	5701	5702
Aluminum	10000 ppm	12800 ppm
Arsenic	5.24 ppm	7.83 ppm
Calcium	2700 ppm	3200 ppm
Cadmium	2.85 ppm	5.35 ppm
Chromium	331 ppm	1300 ppm
Copper	191 ppm	324 ppm
Iron	14900 ppm	15700 ppm
Lead	402 ppm	324 ppm
Magnesium	3400 ppm	2700 ppm
Manganese	373 ppm	224 ppm
Mercury	0.478 ppm	0.689 ppm
Nickel	31.8 ppm	15.5 ppm
Zinc	419 ppm	1500 ppm
TOC		
Petroleum Hydrocarbons	2300 ppm	18000 ppm
Total PCBs	1.15 ppm	0.55 ppm

TABLE E-2
WATER CHEMISTRY RESULTS
UNION POND, MANCHESTER, CT

NSL SAMPLE NO.:	5694	FIELD DESCRIPTION:	Site D - #1D
	5695		Site E - #2E
	5696		Site F - #3F

MATERIAL DESCRIPTION: WATER

PARAMETER	5694		5695		5696	
Aluminum	0.152	ppm	0.177	ppm	0.133	ppm
Arsenic	0.001	ppm	< 0.001	ppm	0.001	ppm
Calcium	18.9	ppm	19.0	ppm	18.8	ppm
Cadmium	< 0.003	ppm	< 0.003	ppm	< 0.003	ppm
Chromium	0.009	ppm	0.009	ppm	0.010	ppm
Copper	0.025	ppm	0.023	ppm	0.025	ppm
Iron	0.284	ppm	0.324	ppm	0.331	ppm
Lead	< 0.001	ppm	0.003	ppm	0.002	ppm
Magnesium	4.17	ppm	4.28	ppm	4.31	ppm
Manganese	0.092	ppm	0.107	ppm	0.111	ppm
Mercury	< 0.0002	ppm	< 0.0002	ppm	< 0.0002	ppm
Nickel	< 0.010	ppm	< 0.010	ppm	< 0.010	ppm
Zinc	0.04	ppm	0.034	ppm	0.03	ppm
Alkalinity	58	ppm	54	ppm	53	ppm
Residual Chlorine	< 0.1	ppm	< 0.1	ppm	< 0.1	ppm
TKN	5.2	ppm	3.8	ppm	3.0	ppm
Nitrite	0.02	ppm	0.02	ppm	0.01	ppm
Nitrate	2.04	ppm	1.95	ppm	1.87	ppm
Ortho-Phosphorus	0.46	ppm	0.33	ppm	0.30	ppm

TABLE E-3
AVERAGED CHEMICAL CHARACTERISTICS OF SAMPLES
UNION POND, MANCHESTER, CONNECTICUT

Chemical (ppm)	Mean	Standard Deviation	Number of Samples	Class II Range
Arsenic	6.6	5.61	6	10-20
Cadmium	4.1	3.35	6	3-7
Chromium	668.4	751.30	6	100-300
Copper	210.8	136.0	6	200-400
Lead	315.6	191.0	6	100-200
Mercury	0.96	0.84	6	0.5-1.5
Nickel	21.0	12.52	6	50-100
Zinc	607.7	474.70	6	200-400
PHC	4282.0	6852.5	6	not appl.
PCB	0.46	0.47	6	>1

TABLE E-4
SEDIMENT CLASSIFICATION SYSTEM OF THE NEW YORK-CONNECTICUT INTERIM PLAN (NERBC, 1980)

Classification	I (Low)	I (Moderate)	III (High)
Parameters			
% Silt-Clay	<60	60-90	>90
% Water	<40	40-60	>60
% Volatile Solids (NED)	<5	5-10	>10
Oil and Grease (ppm)	<2000	2000-7500	>7500
Mercury (ppm)	<0.5	0.5-1.5	>1.5
Lead (ppm)	<100	100-200	>200
Zinc (ppm)	<200	200-400	>400
Arsenic (ppm)	<10	10-20	>20
Cadmium (ppm)	<3	3-7	>7
Chromium (ppm)	<100	100-300	>300
Copper (ppm)	<200	200-400	>400
Nickel (ppm)	<50	50-100	>1000
Vanadium (ppm)	<75	75-125	>125
PCB's (ppb)	--	--	>1000
DDT (ppb)	--	--	>500

VIII. ENVIRONMENTAL ISSUES

A. Potential Impacts on Water Quality

The dredging should not significantly alter the water quality, but the present water quality will certainly influence the recreational potential of the project area. The present water quality classification of Union Pond is Class C with a goal of Class B. The ''Swimability'' of Class C waters (i.e. contact recreation) in Union Pond will need investigation. Coliform bacteria levels, in particular, should be investigated as part of a water quality analysis of the pond. The presence of high fecal coliforms is often indicative of viral pathogens in the water column. This health risk would impact the recreational development of the areas. It is probable that wasterwater treatment plant upgrades will occur in the next few decades, but potential recreational benefits will be dependent on that time frame.

B. Potential Impacts on Biological Communities

The dredging and concomitant development of the shoreland will alter the limnological benthic habitat, emergent wetlands and fisheries potentials of the system. The ultimate change in substrate character will structure the pond's benthic population. This impact will probably be minor, but it would have an overall bearing on the fisheries carrying capacity of the pond. Finfish foraging the bottom for food would have to adapt to the new benthic prey.

Wetlands within and on the periphery of the pond will need to be delineated. Cursory (early-spring) observations identified few wetland species. The cumulative impact of dredging and dredging dependent development of the wetland would require a 404(b)1 evaluation, as well as documentation in the environmental assessment. Aquatic plant control strategies will also be needed to assess potential nuisance weed development based on the new pond hydrology.

Fisheries use of the pond would require documentation. A potential for a fisheries stocking program or management plan could be developed. This would also be dependent on the the water quality characteristic of the with project scenario.

C. Chemical Contamination

The levels of chemical contamination found in the proposed dredging area limits various disposal alternatives. Physical analyses describe the material as unsuitable for resale

as sand or gravel. The inwater disposal of dredged material for habitat creation should be pursued under Section 404(b)1 guidelines of the Clean Water Act (40 CFR 230). The contaminated nature of the sediments precludes this alternative if an upland site is available. The most likely scenarios for dredged material disposal from this project include the use of the nearby sand pits with a liner and/or clay barrier installed; or disposal at nearby landfills for use as daily cover. The latter is most likely to be preferred both environmentally and economically. These alternatives should be pursued further in the feasibility phase.

D. Potential Impacts on Historic and Archaeological Resources

The proposed dredging project will have no effect on historic period sites. A review of historic maps of the area revealed that no known structures were located upstream of the dam in the vicinity of the pond. Industrial and residential structures associated with the Union Manufacturing Company were situated downstream and to the south and southwest of the pond. Therefore, the proposed project should have no effect on significant historic structures or historical archaeological sites.

The proposed project area may have prehistoric site potential. Since this area was originally part of the Hockanum River floodplain, evidence of prehistoric activity could be present at this location. Additional research would need to be performed in this area and soil profiles should be done to look for intact submerged land surfaces. If the soil profiles still contain considerable integrity then an archaeological survey may be required during later study stages.

The proposed disposal area at the adjacent sand and gravel pit has no archaeological potential. The area has been severely modified by the gravel operations and sites which may have been present have been destroyed or seriously compromised. Therefore, disposal of the dredged material at this area is unlikely to have an effect upon any structure or site of historic, architectural or archaeological significance as defined by the National Historic Preservation Act of 1966, as amended. The Connecticut Historical Commission in a letter dated 16 June 1989, has concurred with this finding.

E. Future Studies

Prior to construction additional studies and permit compliances are required. Necessary information identified in

the reconnaissance phase may include benthic and fisheries sampling, wetlands delineation, additional chemical testing, and disposal site analyses.

Additional studies and permits required include:

1. An estimate of the sedimentation rate for maintenance predictions.
2. Chemical testing for upland disposal:
    a. EP Toxicity Test for Metals
    b. EPA Tests
        8010 - Halogenated Volative Organic Compounds
        8015 - Non-halogenated Volatile Organic Compounds
        8020 - Aromatic Volatile Organic Compounds
3. Coordination of Testing protocol & results with Ct. DEP Solid Waste Division and other state DEP Units for upland disposal.
4. A Corps dredging permit must also be obtained.

Optional studies not required for a navigation project project:

1. Contaminant Influx - for development of contact recreation
2. Water Quality Impacts, seasonal conditions, (including dissolved oxygen) for fisheries development potential.
3. Aquatic plant management for fisheries impacts and contact recreation.

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1924 The History of Manchester, Connecticut. Centennial Committee of the Town of Manchester.

ENVIRONMENTAL DATA

FEDERALLY LISTED ENDANGERED AND THREATENED SPECIES IN CONNECTICUT

Common Name	Scientific Name	Status	Distribution
FISHES:			
Sturgeon, shortnose*	Acipenser brevirostrum	E	Connecticut River & Atlantic Coastal Waters
REPTILES:			
Turtle, green*	Chelonia mydas	T	Oceanic straggler in Southern New England
Turtle, hawksbill*	Eretmochelys imbricata	E	Oceanic straggler in Southern New England
Turtle, leatherback*	Dermochelys coriacea	E	Oceanic summer resident
Turtle, loggerhead*	Caretta caretta	T	Oceanic summer resident
Turtle, Atlantic ridley*	Lepidochelys kempii	E	Oceanic summer resident
BIRDS:			
Eagle, bald	Haliaeetus leucocephalus	E	Entire state
Falcon, American peregrine	Falco peregrinus anatum	E	Entire state-reestablishment to former breeding range in progress
Falcon, Arctic peregrine	Falco peregrinus tundrius	E	Entire state migratory-no nesting
Plover, Piping	Charadrius melodus	T	Entire state - nesting habitat
Roseate Tern	Sterna dougallii dougallii	E	Atlantic Coast
MAMMALS:			
Cougar, eastern	Felis concolor couguar	E	Entire state-may be extinct
Whale, blue*	Balaenoptera musculus	E	Oceanic
Whale, finback*	Balaenoptera physalus	E	Oceanic
Whale, humpback*	Megaptera novaeangliae	E	Oceanic
Whale, right*	Eubalaena spp. (all species)	E	Oceanic
Whale, sei*	Balaenoptera borealis	E	Oceanic
Whale, sperm*	Physeter catodon	E	Oceanic
MOLLUSKS: NONE			
PLANTS:			
Small Whorled Pogonia	Isotria medeoloides	E	Hartford, New Haven, Fairfield, New London, Windham, Tolland, Middlesex, Litchfield Counties

Except for sea turtle nesting habitat, principal responsibility for these species is vested with the National Marine Fisheries Service

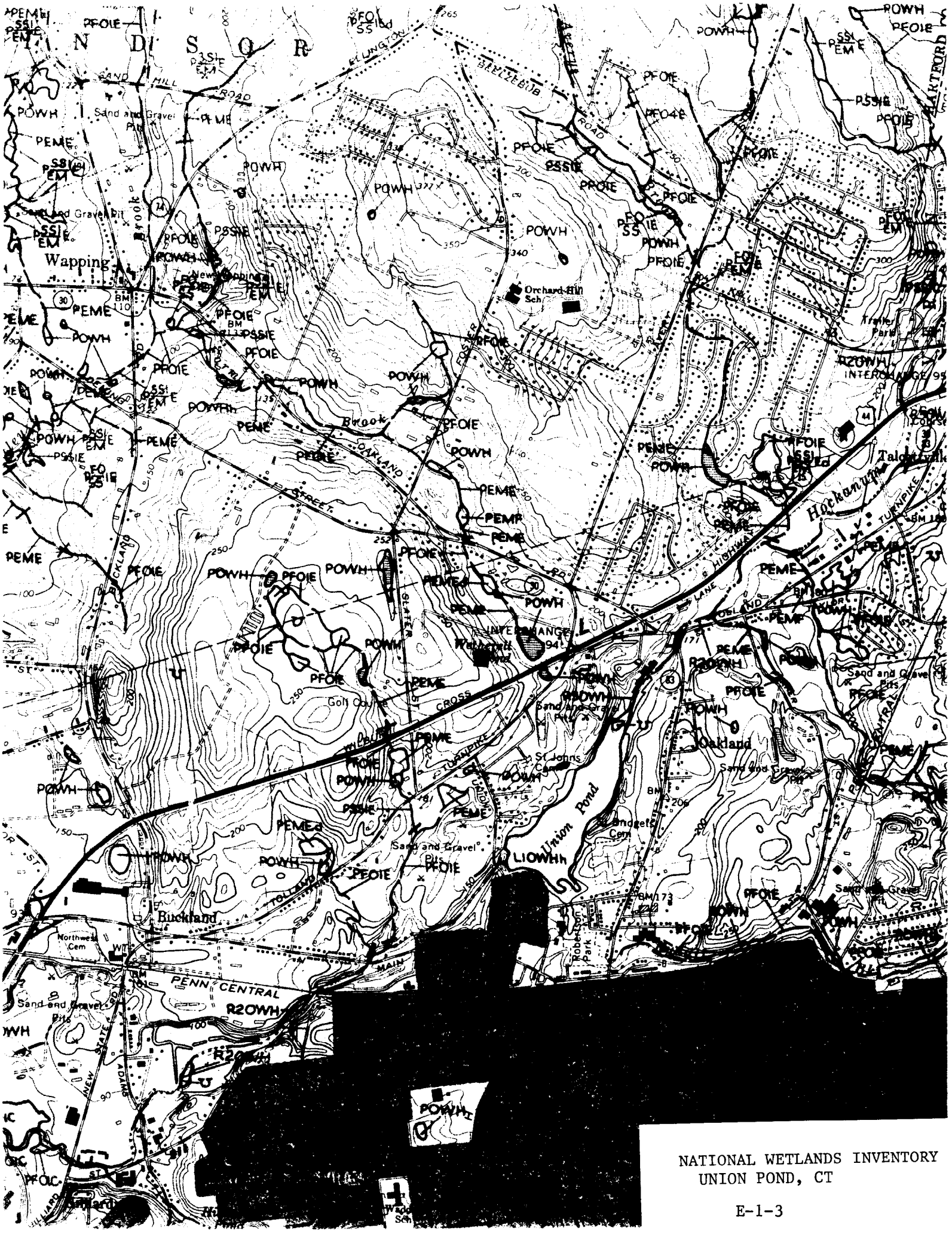
Rev. 1/25/88

UNION POND SURVEY-JULY 6,7 - 1977
MANCHESTER, CT

Source: Connecticut Department of Environmental Protection
May 1989

	pH	Conductivity	Dissolved Oxygen 7-6-77	Dissolved Oxygen 7-7-77	Temperature 7-6-77	Temperature 7-7-77
S	6.4	C_{18} = 257 umhos	9.2 ppm	6.7 ppm	24.6 °C	22.9 °C
1m			4.9 ppm	6.0 ppm	23.0 °C	22.2 °C
2m			1.0 ppm	0.7 ppm	20.9 °C	20.4 °C
3m	6.2	C_{18} = 235 umhos	0.2 ppm	0.1 ppm	18.2 °C	18.2 °C
4m			0.2 ppm	0.1 ppm	14.3 °C	14.0 °C
5m			0.2 ppm	0.1 ppm	12.3 °C	12.0 °C
6m	6.6		0.2 ppm	0.2 ppm	12.0 °C	11.1 °C

*Note almost no D.O. below 5 feet



NATIONAL WETLANDS INVENTORY
UNION POND, CT

E-1-3

HOCKANUM RIVER AT UNION POND

MANCHESTER, CONNECTICUT

NAVIGATION IMPROVEMENT STUDY

APPENDIX F

ECONOMIC ANALYSIS

APPENDIX F
Economic Analysis

Methodology

The purpose of this study is to identify and evaluate the economic benefits of dredging approximately 70,000 cubic yards of material from Union Pond. Union Pond is located on the Hockanum River in Manchester, Connecticut. The area to be dredged is the northern one-third of the pond which currently has depths of zero to three feet. The dredging would allow the entire pond, instead of just the southern section, to be used for small recreational boating.

All benefits and costs are stated in their June 1989 prices, and are converted to their present value equivalent based on the 1989 federal interest rate for water resources projects of 8-7/8%.

Economic Study Area

The economic study area consists of Union Pond and Manchester, CT. Manchester is located in central Connecticut, two towns east of the city of Hartford. In the 1800's, Manchester was an important mill town, with paper, cotton, and textile mills forming the base of the town's economy. Today, Manchester's economy is based both on defense, financial, and retail industries located in Manchester, and on the economy of the city of Hartford, where an estimated one-half of Manchester's labor force is employed.

Manchester had a 1985 population of 50,562. The population of Manchester increased by 16% between 1960 and 1970, increased by 3.7% from 1970 to 1980, and is projected to continue to grow at a moderate rate of 3% to 4% through 1995 (Town of Manchester, ''Plan of Development'', July 1986). Significant residential real estate development has been occurring in Manchester in the 1980's, part of the housing boom of the greater Hartford area and the whole northeastern United States. There are currently plans for a regional retail shopping mall to be built on the northern edge of the town. The mall would service the Hartford metropolitan region east of the Connecticut river. The plans for the mall are already attracting retail, service and residential development to the northern section of town before construction has even

begun. Any recreational development at Union Pond and the adjacent land area will help meet the increasing recreational needs of a growing town.

Biological Study Area

The biological study area consist of Union Pond and the adjacent town-owned land. Union Pond is a 52 acre freshwater pond, formed by the damming of the Hockanum River by an old mill dam. The Hockanum River is approximately twenty miles long, running through the towns of Vernon, Ellington, and Manchester, to the city of East Hartford, where it joins the Connecticut River. Currently, the water quality in Union Pond is classified by CTDEP as Class C, not meeting the adopted Class B standard. This water quality condition is due to an inadequate wastewater treatment plant upstream of the pond and due also to deposits from manufacturing mills which have operated on the river over the past 200 years as well as non-point source contamination from upstream agricultural runoff. The town hopes that improvements to the upstream wastewater treatment plant, planned to be completed within the next decade, will improve the water quality of Union Pond from Class C to Class B. Contact recreation (swimming) with Class C water is questionable. Swimming in Union Pond will be dependent on the success and timing of the wastewater treatment improvements upstream and the bacterial and aesthetic characteristics of the pond. Fishery development of the pond will also depend on upstream water quality improvements.

The town of Manchester owns a 6 acre parcel of land at the south end of Union Pond, and a 24 acre parcel of land at the north end of Union Pond. The 6 acre parcel of land contains an earthen boating ramp, a skating rink (which drains too quickly and so is not used) and a parking area. The southern end of the pond is currently used for small boat recreational boating, used primarily by residents located on or very near the pond. The northern end of the pond is not used for boating as it is too shallow. The 24 acre parcel of land at the northern end of the pond is currently undeveloped.

Without Project Condition

Based on discussions with Manchester planning personnel, the without project condition of Union Pond is the development of land-based recreation facilities on the 24 acre parcel of land at the north end of Union Pond. The development would include athletic fields, picnic groves, walking and bicycling paths, and

other similar land-based recreational activities. This development would be part of an extensive linear park planned to run up and down the Hockanum River from the town of Ellington to the city of East Hartford.

With Project Condition

With the proposed federal project, there would be development of water-based recreation facilities at the north end of Union Pond in addition to the land-based facilities planned as described above in the without project condition. The water-based recreation facilities would include a boat ramp, boat trailer parking area, and other supporting, boating-related facilities. With the proposed project, the boating experience in Union Pond would be improved as boaters would be able to enjoy the whole pond instead of just the southern half. The improved boating experience with the project would also attract new boaters to Union Pond.

The proposed federal project would not, however, measurably affect the water quality of the pond. The improvement plan from Class C to Class B water quality is dependent on factors not related to the project and will or will not take place regardless of the project. Thus, neither improvement of the water quality of the pond, nor the use of the pond for swimming, nor the development of fisheries are included in the with project condition.

Benefits to the Project

The major benefit to accrue to the proposed dredging project is increased recreational boating and a more pleasant recreational boating experience. No benefits are taken for the improvement of water quality nor for the development of activities related to water quality such as swimming and fishing. No benefits are taken for the development of the land-based recreation at the town-owned 24 acre parcel of land, as this development is assumed to occur in the without project condition whether or not the pond is dredged. Recreational benefits for increased quantity and improved quality of recreational boating are calculated using the unit day value method as described in Corps planning guidance ER 1105-2-40 Section VII Appendix 3.

Unit Day Value Calculations

The increased recreational boating benefits will accrue to two groups of recreational boaters: (1) those who currently boat in Union Pond, who will gain more enjoyment from the activity with the project, and (2) new boaters who will be attracted to the pond as a result of its improved condition with the project.

Projected annual recreational boater usage of Union Pond in the with project condition is based on case studies of recreational boater usage at small lakes with similar facilities as will be developed at Union Pond in the with project condition. Authorities managing boat launches at Bolton Lake and Lake McDonough, both in Connecticut, and at Lake Cochituate in Massachusetts were contacted. Boat launch user rates at these locations were used to predict the likely number of users at Union Pond with the project, taking into account differences in water body size, availability of support facilities, and population density of surrounding communities.

The unit day values for the with and without project condition are calculated below in the following table. The table displays the assignment of judgement factors to the recreational criteria and the resulting point totals for the without and with project conditions. The point totals are then converted to dollar values based on Table VIII-3-1 (FY 1989 Handbook).

Criteria	Points	
	WITHOUT PROJECT	WITH PROJECT
Recreational Experience	4	4
Availability of Opportunity	4	4
Carrying Capacity	6	12
Accessibility	4	16
Environmental Quality	2	8
Total	20	44
Converted to Dollars	$2.60	$3.75

The unit day value for each new boater attracted to Union Pond with the project equals $3.75, the value of the with project condition.

The unit day value for each user who currently boats at the south end of Union Pond but will gain more enjoyment from the boating experience with the project equals $1.15, the increase in unit day value from the without project condition to the with project condition ($3.75 - $2.60 = $1.15).

Projected Number of Users

Based on the user rates of similar recreational areas, it is estimated that, with the project, Union Pond will attract 5,288 recreational boaters per year, of which 4,517 will be new users attracted to Union Pond because of the improvements, and 771 will be returning users who currently boat on the south end of the pond but will enjoy an improved quality of experience with the project.

The projected number of users per season at Union Pond of 5,288 is derived in the following way:

- Based on the number of boat launches at similar harbors, taking into account differences in water body size, availability of support facilities, and population density of surrounding communities, it is estimated that, with the project, there would be 70 boat launches per weekend day and 20 boat launches per weekday at Union Pond.

- Based on the length of boating season at similar harbors, it is estimated that the boating season at Union Pond would last from mid-May through September, or 20 weekends and 19 weeks.

20 weekends X 2 days/wkend = 40 weekend days
40 weekend days X 70 launches/wkend = 2,800 wkend launches

19 weeks X 5 days/wk = 95 weekdays
95 weekdays X 20 launches/wk = 1,900 wkday launches

2,800 + 1,900 = 4,700 total launches

- For the purpose of this analysis, it is estimated that 75% of the days in the season there would be good weather for boating, or 25% of the days bad weather would prevent usage of the boat launch.

4,700 X 75% = 3,525 total boat launches per year

- The boat launch would be used by sail boards, canoes, sunfishes, and rowboats. Sail boards have one user per boat launch, the other boat types have one or two users per boat. For this analysis, it was assumed that each launch would have, on average, 1.5 persons per launch.

3,525 X 1.5 = 5,288 total users per year

5,288 projected users per year is within the range for projected usage estimated by town officials. The town estimated that, with the project, Union Pond would attract between 25 and 75 users per day. The town estimates did not break usage down into week day and weekend day. The above methodology, using 20 launches per weekday, 70 launches per weekend day, and 1.5 average users per launch, yields 30 users per weekday and 113 users per weekend day, within and above the range estimated by the town.

Total Annual Benefits

The annual benefit for the new boaters equals $16,939, the number of new boaters with the project times the user day value for each new boater (4,517 X $3.75 = $16,939 Say $16,900).

The annual benefit for the returning boaters equals $887, the number of returning boaters times the user day value for each returning boater (771 X $1.15 = $887 Say $900).

Total annual benefits with the project equal $17,800, the sum of the annual benefits for new and returning boaters ($16,900 + $900 = $17,800).

Economic Summary

In order for a proposed project to be considered economically justified, the benefit-cost ratio of the project must be greater than or equal to 1. The annual benefits, annual costs, benefit-cost ratio, and net annual benefits of the proposed dredging of Union Pond are shown in Table F-1. Cost estimates were computed for four incremental depths. Benefits, however, were developed for recreational boating activity only. The water quality problems which discourage swimming and other water contact activities would not be entirely solved by a dredging project, but would require the elimination of upstream sources of contaminents. The

same level of benefits would therefore accrue at any dredge depth in excess of the minimum necessary to meet the requirements of a small sailing craft, determined to be a depth of about 5 feet below the spillway crest elevation.

TABLE F-1
HOCKANUM RIVER AT UNION POND
ECONOMIC SUMMARY

	-5 Feet	-6 Feet	-7 Feet	-8 Feet
Annual Cost	$ 37,100	$ 51,400	$ 73,800	$111,200
Annual Benefits	$ 17,800	$ 17,800	$ 17,800	$ 17,800
Net Annual Benefits	None	None	None	None
Benefit-Cost Ratio	0.48	0.35	0.24	0.16